IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF OHIO
EASTERN DIVISION

Case No. 1:19-cv-1611-DCN

The Honorable Donald C. Nugent

Terves LLC

vs.

Yueyang Aerospace New Materials Co. Ltd.
et al.

Rule 26 Report of Lee A. Swanger, Ph.D., P.E.

July 27, 2021

I. Introduction

A. Background/scope of engagement

Attorneys for Terves LLC have retained me and my colleagues at Exponent, Inc. to perform certain metallurgical and corrosion tests on several magnesium alloys sold by Ecometal, Inc. and to compare the results of those tests to the claims of two U.S. Patents assigned to Terves LLC: U.S. Patent 10,329,653 (the '653 Patent) and U.S. Patent 10,689,740 (the '740 Patent). I have also been asked to review and evaluate the Supplemental Declaration of Dr. Dana Medlin, dated October 15, 2020, including the Exhibits thereto. In that Declaration, Dr. Medlin challenges my conclusions in my report dated August 6, 2020, wherein I concluded that seven Ecometal magnesium composites infringe certain claims of U.S. Patent 10,689,740 (the '740 Patent) asserted against the Ecometal magnesium composites. I have provided four earlier reports in this matter, dated

April 28, 2020, May 4, 2020, August 6, 2020, October 6, 2020, and November 20, 2020 which I incorporate herein by reference. I have also given depositions in this matter on June 3, 2020 and on October 12, 2020 and incorporate the transcripts of those depositions, with the respective errata sheets, in this report by reference.

B. Qualifications

I am employed by Exponent, Inc. as a Principal Engineer, and Director of Exponent's Miami, Florida office. My background is in the area of both metallurgical engineering including physical metallurgy and mechanical engineering. I have a B.S. in Metallurgy, with Highest Honors, from the Case Western Reserve University, an M.S. in Materials Science and Engineering from Stanford University, and a Ph.D. in Materials Science and Engineering, also from Stanford University. I then joined The Ohio State University Department of Materials Science and Engineering as a Post-Doctoral Research Associate studying corrosion, in conjunction with Professor Mars Fontana and Professor Roger Staehle. I have served as an Adjunct Professor of Engineering, teaching metallurgical engineering, at the University of Miami, and at Cleveland State University. I am a Registered Professional Engineer in several states, including the Ohio, in both metallurgical engineering and in mechanical engineering, and have been a member of ASM International (formerly the American Society for Metals) since 1968. As set forth in more detail in my curriculum vitae (Exhibit A), I have substantial experience in the areas of metallurgical engineering and alloy design. Prior to joining Exponent, I was Director of Research and Development for the Engine Parts Division of Gould, Inc. While at Gould I was the sole inventor of U.S. Patent 4,333,215 in the metallurgical art, and assisted my attorney in the prosecution of that patent. One of my responsibilities at Gould was the management of its intellectual property portfolio, including monitoring progress on research and development projects and monitoring patent applications.

C. Facts and Data Considered

A listing of the facts, documents and items considered in the course of this analysis and report is attached hereto (Exhibit B)

D. Any Exhibits that may be used at hearing

I reserve the right to use as exhibits in support of my testimony any material referred to in my April 28, 2020, May 4, 2020, August 6, 2020 October 6, 2020, and November 20, 2020 reports, this report and/or the exhibits thereto, my deposition transcripts and exhibits and any demonstrative or summary exhibits explaining, illustrating or summarizing any of the opinions expressed in this report or the information contained in it, referenced by it, or reviewed in connection with it.

E. List of all publications authored in previous 10 years

A list of my publications is included in the resume attached (Ex. A).

F. A list of all other cases in which, during the previous 4 years, the witness testified as an expert at trial or by deposition

My list of sworn testimony is attached hereto (Exhibit C).

G. Statement of compensation to be paid for the study and testimony in the case

I am a salaried employee of Exponent, Inc. My employer charges for my professional services at the rate of $575 per hour. Neither my employer nor I have any financial interest in the outcome of this matter.

II. Applicable Law

<u>Claim Construction</u>

1. I understand that the parties agreed to the construction of certain claim terms in two documents: the *Joint Claim Construction and Prehearing Statement* (ECF 50), and the *Joint Memorandum on Agreements re Certain Disputed Claim Terms* (ECF 86).

2. In the *Joint Claim Constructions and Prehearing Statement* (ECF 50), the parties agreed to the following:

   A. **Additive material:** a material that is added.

   B. **Secondary metal:** an additional metal that is added.

   C. **Forming precipitant:**

   i. **Forming:** coming into existence

   ii. **Precipitant:** something having a new phase different from what existed before.

   D. **Morphology of said galvanically-active intermetallic phases:** shape of said galvanically-active intermetallic phases.

3. In the *Joint Memorandum on Agreements re Certain Disputed Claim Terms* (ECF 86), the parties agreed to the following:

   E. **Composite**: a material made of two or more components.

   F. **in situ precipitation/precipitate / in situ precipitated intermetallic phase**:

   "in situ": in place

   "precipitant/precipitate/precipitation": something having a new phase different from what existed before.

G. **Controlled Dissolving**: Parties agree the term does not require construction because it is not a limitation of the claims.

H. **controlled selection of a mixing technique**: a non-random selection of a mixing technique.

I. **solutionizing**: a heat treatment process step.

4. The Court also issued a *Memorandum Opinion and Order* (ECF 89). The Court identified that the agree constructions are as follows:

A. Agreed Terms

The agreed constructions are as follows:

1. "*composite*": a material made of two or more components

2. "*in situ*": in place

3. "*precipitation*"/"*precipitate*"/"*precipitated*"/"*precipitant*": something having a new phase different from what existed before

4. "*controlled selection of a mixing technique*": a non-random selection of a mixing technique

5. "*solutionizing*": a heat treatment process step

6. "*additive material*": a material that is added

7. "*secondary metal*": an additional metal that is added

8. "*forming*": coming into existence

9. "*morphology*": shape

5. The Court then made a determination the following terms:

Intermetallic Phase: solid compound that has a combination of two or more metals

Galvanically-Active: No construction is warranted.

Unalloyed Additive Material: Further explanation is not necessary to aid the court or the jury in understanding this term as it is used in the claimed invention.

Sufficient quantities: Further explanation is not necessary to aid the court or the jury in understanding this term as it is used in the claimed invention.

Improve tensile strength, ductility, or combination thereof: provide a greater tensile strength (resistance of a material to break under tension), greater ductility (ability to undergo deformation before rupture), or combinations thereof.

Melting Point/Melting Temperature: the temperature at which liquid is first formed.

Portion of said additive materials forming solid particles/a portion of said additive material remaining unalloyed additive material: This term is not indefinite by clear and convincing evidence, and the term needs no further construction.

6. For my report and for my opinions, I am using the Court's Order (ECF 89) regarding the claim construction terms as well as the parties' stipulations in the *Joint Claim Construction and Prehearing Statement* (ECF 50), and the *Joint Memorandum on Agreements re Certain Disputed Claim Terms* (ECF 86).

7. The parties have not agreed on a definition for the claim term "plurality" and the Court has not construed this term. Claim 19 of the '740 Patent uses the term "plurality" which is defined in the Merriam Webster Ninth New Collegiate Dictionary as 1 a: the state of being plural (i.e. more than one, or in some languages more than two), b: the state of being numerous, c: a large number or quantity. I understand that courts have construed "plurality" in claims consistent with the term's ordinary meaning to mean "two or more." E.g., Dayco Products, Inc. v. Total Containment, Inc., 258 F.3d 1317, 1327-28 (Fed. Cir. 2001) ("In accordance with standard dictionary definitions, we have held that 'plurality,' when used in a claim, refers to two or more items, absent some indication to the contrary."). I use the definition of plurality to mean "two or more" consistent with the dictionary definition and with referenced Federal Circuit opinion.

Legal Standard for Infringement

I apply a two-step analysis to determine whether accused devices literally infringe a patent's claims. First, the claims are "construed to determine their scope." Telemac Cellular Corp. v. Topp Telecom, Inc., 247 F.3d 1316, 1330 (Fed. Cir. 2001). Second, "the claims must be compared to the accused device." Id. "Literal infringement exists when every limitation recited in the claim is found in the accused device." Akzo Nobel Coatings, Inc. v. Dow Chem. Co., 811 F.3d 1334, 1341 (Fed. Cir. 2016). "

IV. Summary of Opinions

Exponent, Inc. received ten samples of different grades of magnesium composite billets that Ecometal imports from China to the U.S. We tested the samples for elemental composition and for dissolution rate as specified in the '653 Patent and the '740 Patent, consistent with ASTM G31: Standard Practice for Laboratory Immersion Corrosion Testing of Metals.

Based on that testing and my education, background, training and experience in metallurgy and corrosion, I have concluded that seven grades of Ecometal magnesium composites, AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 infringe those claims of the ‘653 Patent with an “x” in the cell of the following Chart 1 either directly or indirectly:

‘653 Claim No.		AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
1		x	x	x	x	x	x	x
2		x	x	x	x	x	x	x
3		x		x	x		x	x
4		x	x	x	x	x	x	x
5		x		x	x	x	x	
7		x	x	x	x	x	x	x
9		x	x	x	x	x	x	x
12		x	x	x	x	x	x	x
13		x	x	x	x	x	x	x
14		x		x	x		x	x
15		x	x	x	x	x	x	x
18							x	x
19		x		x	x			x
20		x	x	x	x	x	x	x
23							x	x
Claim No.		AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
25		x		x	x		x	x
26								x
27		x		x	x		x	x
29							x	x
30							x	x
31							x	x
33		x						
34		x						
35		x						
37								x
38								x
39								x
41		x		x	x		x	x
42		x		x	x		x	x
43		x		x	x		x	x
45		x		x	x		x	x

46		x		x	x		x	x
47		x		x	x		x	x
49		x	x	x	x	x	x	x
50		x	x	x	x	x	x	x
Claim No.		AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
52		x	x	x	x	x	x	x
53		x		x	x		x	x
54		x		x			x	x
55		x		x	x		x	x
56							x	x
57								x
58		x						
59		x		x	x		x	x
60		x		x	x			x
61		x	x	x	x	x	x	x
64		x		x	x	x	x	
66		x	x	x	x	x	x	x
67							x	x
69		x	x	x	x	x	x	x
70		x	x	x	x	x	x	x
74							x	x
76							x	x

Chart 1. Claims of the ‘653 Patent infringed by seven Ecometal magnesium composites

Based on that testing and my education, background, training and experience in metallurgy and corrosion, I have concluded that seven grades of Ecometal magnesium composites, AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 infringe those claims of the ‘740 Patent with an “x” in the cell of the following Chart 2 either directly or indirectly:

‘740 Claim No.		AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
2							x	x
3							x	x
4							x	x
5								x
8							x	x
9							x	x

10						x	x
11						x	x
13						x	
16						x	x
17						x	x
19	x	x	x	x	x	x	x
20	x	x	x	x	x	x	x
21						x	x
22						x	x
23	x	x	x	x	x	x	x
24	x	x	x	x	x	x	x
25						x	x
26						x	x
27	x	x	x	x	x	x	x
28						x	x
29						x	x
30						x	x
Claim No.	AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
31						x	x
32						x	x
33						x	x
34						x	x
35	x	x	x	x	x	x	x
36						x	x
37	x		x	x		x	x
38						x	x
39	x		x	x		x	x
40						x	x
41	x		x	x		x	x
42						x	x
43	x		x	x		x	x
44	x		x	x		x	x
45						x	x
46	x		x	x		x	x
47						x	x
51	x		x	x		x	x
52	x	x	x	x	x	x	x
53	x	x	x	x	x	x	x
54						x	x
55	x	x	x	x	x	x	x
56	x	x	x	x	x	x	x

57						x	x
58	x		x	x	x	x	
59	x		x	x	x	x	
60						x	
Claim No.	AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
61	x		x	x	x	x	
62						x	
63						x	
64			x		x	x	
65			x		x	x	
66						x	
67			x		x	x	
68			x		x	x	
69						x	
76	x	x	x	x	x	x	x
77						x	x
78						x	x
79	x	x	x	x	x	x	x
80	x	x	x	x	x	x	x
81						x	x
82	x	x	x	x	x	x	x
83	x	x	x	x	x	x	x
84						x	x
85						x	x
86	x	x	x	x	x	x	x
87						x	x
88		x		x	x	x	x
89		x		x	x	x	x
90						x	x
Claim No.	AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
91		x		x	x	x	x
92		x		x	x	x	x
93						x	x
94						x	x
95						x	x
96						x	x
97						x	x
98						x	x
99						x	x
100						x	x
101						x	x

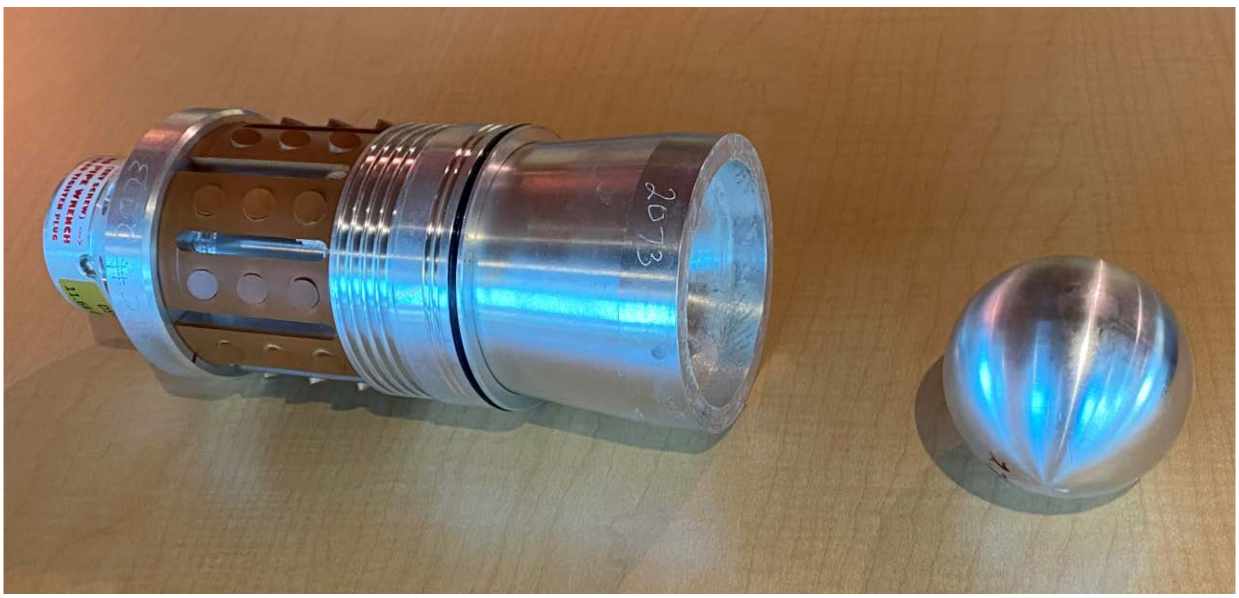
102							x	x
103							x	x

Chart 2. Claims of the ‘740 Patent infringed by seven Ecometal magnesium composites

I reach these conclusions with a reasonable degree of scientific and engineering probability.

V. Background of the ’653 Patent

The present invention is novel magnesium composites where the composite elemental composition and microstructure can be controlled to achieve desirable dissolution rates under specified environmental conditions, along with beneficial mechanical properties. These magnesium composites are particularly useful in petroleum production via the fracking process, and the subject magnesium composites may be machined into frac balls and frac plugs to assist in fracking operations. Examples of the products made from these magnesium composites are shown in the photograph below.



Typical frac plug and frac ball machined from dissolvable magnesium composites

Metallic additives with specific ranges of elemental composition are introduced into the magnesium alloy during the melting process at specific temperatures. The addition of the additive material results in the development of secondary phase particles during cooling to room temperature, which remain in the magnesium composite at temperatures between room temperature and at least 90° C.

These secondary phase particles result either through in-situ diffusion-driven formation of intermetallic phase particles and/or particles of unreacted additive material that persist when the alloy is cooled to room temperature. These secondary phase particles are designed and optimized to have an elemental composition that results in the formation of "galvanically active intermetallics" that induce controlled accelerated corrosion at elevated temperatures in certain brine solutions of an otherwise corrosion resistance magnesium alloy.

Optimization of the specialized casting process for unreacted additive particles requires adding additive to the magnesium alloy in a temperature range above the melting temperature of the magnesium alloy but below the melting temperature of the additive material. In effect, the result is that the additive material is added as a solid, remains as a solid and does not melt and become homogenous with the magnesium alloy.

Under optimized conditions, some additives can undergo solid/liquid diffusion to form intermetallic compounds that result in mechanical property optimization and dissolution rate control. The resulting magnesium composite is the combination of the magnesium alloy plus the additive material.

The specification of the '653 Patent teaches that certain additive elements, including copper, nickel, iron, cobalt, titanium, and silicon, will create galvanically active intermetallic phases or galvanically active intermetallic particles under melting and alloying conditions taught in the specification. Galvanically active means that the particles in intermetallic phases are sufficiently noble or cathodic to the surrounding magnesium alloy such that galvanic corrosion will occur when the magnesium composite is subjected to an aqueous electrolyte under certain conditions of concentration of ionic species and temperature.

Typical galvanic series demonstrate that the additives copper, nickel, iron, titanium, and cobalt will be cathodic with respect to magnesium and magnesium alloyed with zinc, aluminum, zirconium, bismuth, and certain rare earth elements added to the magnesium alloy for grain refinement or increases in tensile strength and/or ductility.

In addition, the paper of Hawke et al. (SAE 930751, March 1993), which references Hanawalt's work on "Corrosion Studies of Magnesium and Its Alloy", presents the quantitative electrochemical potentials of Mg_2Cu and Mg_2Ni, which are sufficiently noble or cathodic to that of magnesium alloys to categorize these intermetallic phases as galvanically active in magnesium composites. These intermetallic phases, Mg_2Cu and Mg_2Ni, are two of the galvanically active intermetallic phases disclosed in the '653 Patent.

The inventions of the '653 Patent are claimed as ranges of chemical composition of the claimed magnesium composites, including the additives which will create galvanically active intermetallic phases via precipitation, as well as the alloying elements, if any, that will develop desired mechanical properties in the magnesium composite. The claims also claim the range of dissolution

rates that the claimed magnesium composite will exhibit under claimed corroding environmental conditions.

VI. Background of the ’740 Patent

The present invention discloses novel magnesium composites where the composite elemental composition and microstructure can be controlled to achieve desirable dissolution rates under specified environmental conditions, along with beneficial mechanical properties.

Metallic additives in the form of pure elements of master alloys, with specific ranges of elemental composition, are introduced into the magnesium alloy during the melting process. The addition of the additive results in the development of secondary phase particles during cooling to room temperature, which remain in the magnesium composite at temperatures between room temperature and at least 90° C.

These secondary phase particles result either through in-situ diffusion-driven formation of intermetallic phase particles and/or particles of unreacted additive material that persist when the alloy is cooled to room temperature. These secondary phase particles are designed and optimized to have an elemental composition that results in the formation of “galvanically active intermetallics” that induce controlled accelerated corrosion at elevated temperatures in certain brine solutions of an otherwise corrosion resistance magnesium alloy.

Under optimized conditions, some additives can undergo solid/liquid diffusion to form intermetallic compounds that result in mechanical property optimization and dissolution rate control. The resulting magnesium composite is the combination of the magnesium alloy plus the additive material.

The specification of the ‘740 Patent teaches that certain additive elements, including copper and nickel, will create galvanically active intermetallic phases or galvanically active intermetallic particles under melting and alloying conditions taught in the specification. Galvanically active means that the particles in intermetallic phases are sufficiently noble or cathodic to the surrounding magnesium alloy such that galvanic corrosion will occur when the magnesium composite is subject to an aqueous electrolyte under certain conditions of concentration of ionic species and temperature. The ‘740 Patent, in claim 19, has a specific limitation on the size of a plurality of the particles that is related to the methods for controlling the size of the particles.

The inventions of the ‘740 Patent are claimed as ranges of chemical composition of the claimed magnesium composites, including the additives which will create galvanically active intermetallic phases via precipitation, as well as the alloying elements, if any, that will develop desired mechanical properties in the magnesium composite. The claims also claim the range of dissolution rates that the claimed magnesium composite will exhibit under claimed corroding environmental

conditions. Claims 82 through 93 which have limitations on the mechanical properties of the claimed magnesium composites.

VII. Summary of Test Findings

A. Testing performed and Test Methods

Exponent performed immersion corrosion using ASTM G31: Standard Practice for Laboratory Immersion Corrosion Testing of Metals as a guide combined with standard operating procedures developed by Terves for testing of their alloys under specific conditions consistent with the claims. All of the magnesium alloys received were prepared and tested in 3% KCl at 90 °C. Figure 1 illustrates the test setup.

Testing Setup

- Each sample was suspended in a separate tall form 1000 ml beaker filled with 800 ml of test solution.
- The temperature was adjusted to 90°C and sample were introduced into the test solution and suspended from the lid.
- Samples were exposed to the test solution for 6 hours. Note that the dissolution rate was higher on some samples and repeated with a shorter exposure time (3 hours).
- After 6 hours, the samples (still in their respective bag) were removed from the test solution, rinsed with water, and dried.
- The final mass of each sample was measured and recorded.
- The final dimensions were measured and recorded.

Figure 1. Test setup for determining dissolution of Ecometal magnesium composites

The dissolution rate of each alloy composition was calculated from measurements made during testing. Figure 2 shows representative examples of the Ecometal magnesium composites before and after testing for dissolution rate in 3% KCl at 90°C.

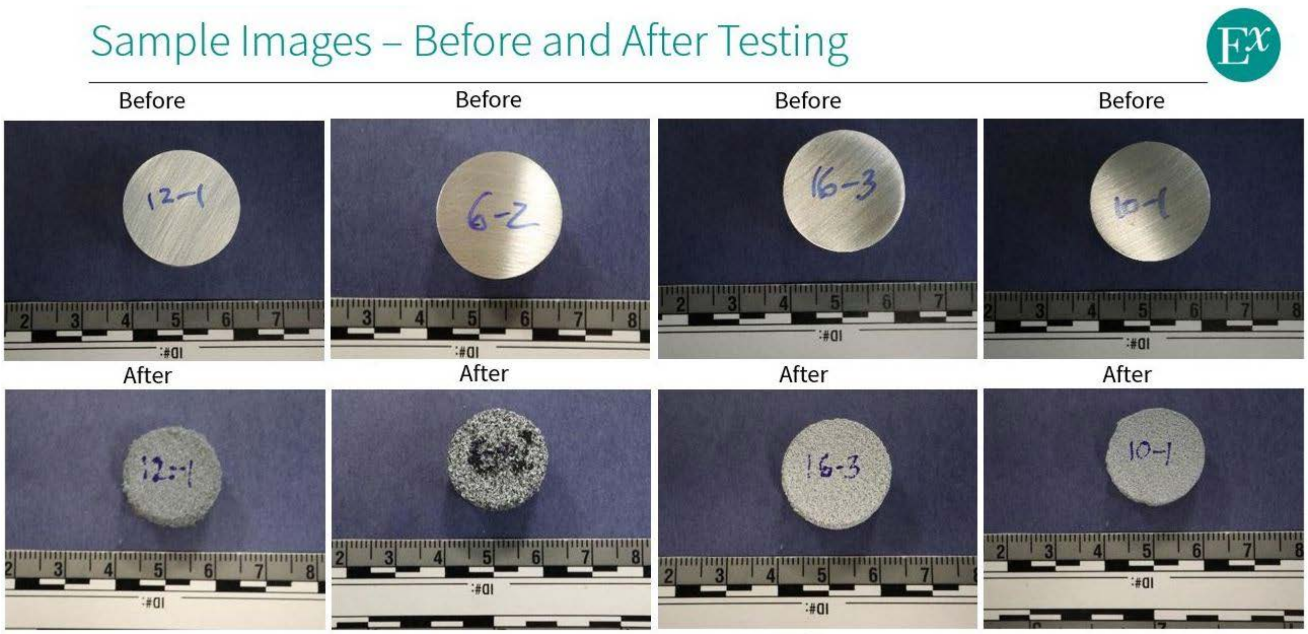


Figure 2. Before and after photographs of AJM012, AJM006, AJM016 and AJM010 Ecometal magnesium composites subjected to dissolution testing

Exponent performed metallurgical analysis of each of the alloys using ASTM E3: Standard Guide for Preparation of Metallographic Specimens as a guide. Each sample was mounted in epoxy, polished using standard methods for magnesium alloys, and examined with the aid of an optical microscope and scanning electron microscope (SEM) and elemental analysis by energy dispersive X-ray spectroscopy (EDS). Representative locations were documented for each magnesium alloy composite. Elemental analysis of each alloy composite, magnesium alloy, and observed secondary phases was performed. Figures 3, 4, and 5 present representative SEM and EDS results for three of the seven Ecometal magnesium composites evaluated. Similar results for the other four Ecometal magnesium composites have been provided in materials produced in the course of this litigation. All seven of the accused Ecometal magnesium composites contain nickel-rich or copper-rich particles, or both. Additional evidence of these particles and their sizes is contained in the optical micrographs presented in Exhibit D to this report.

AJM006

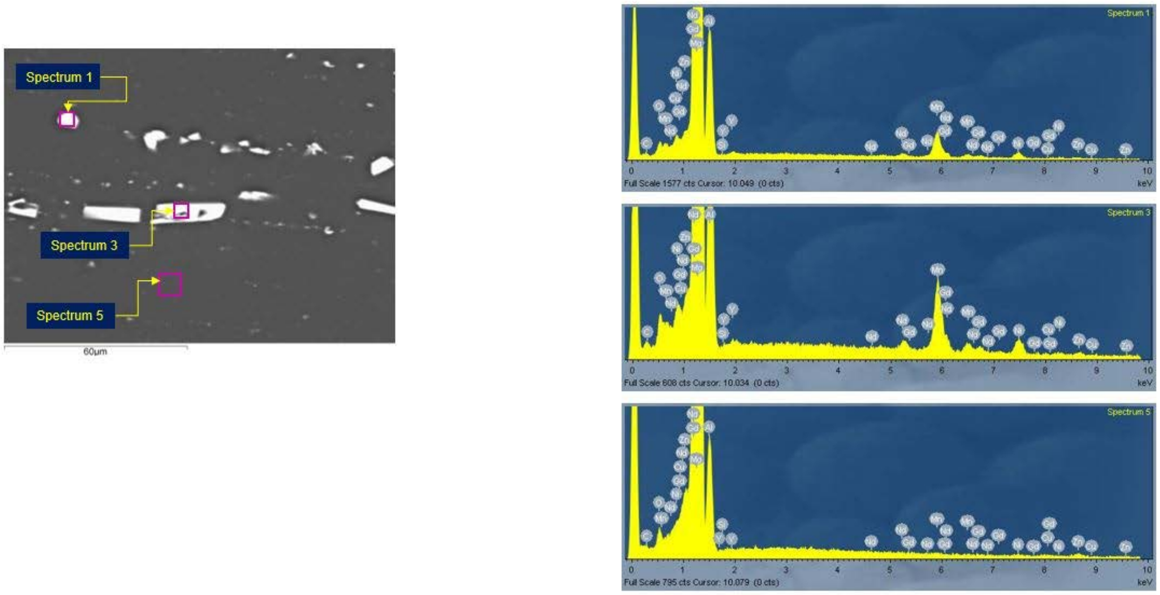


Figure 3. AJM006 SEM and EDS results showing manganese-rich and nickel-rich particles in magnesium-aluminum alloy matrix

AJM016

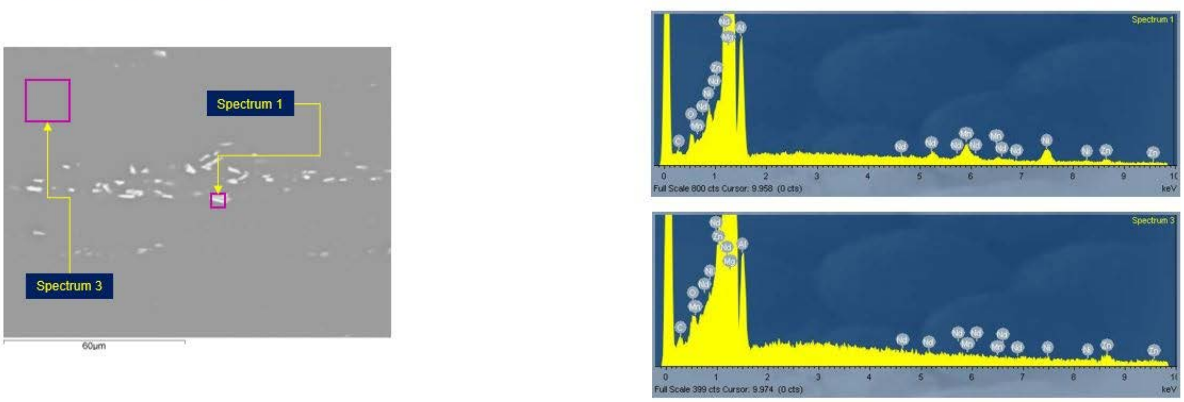


Figure 4. AJM016 SEM and EDS results showing manganese-rich and nickel-rich particles in magnesium-aluminum alloy matrix

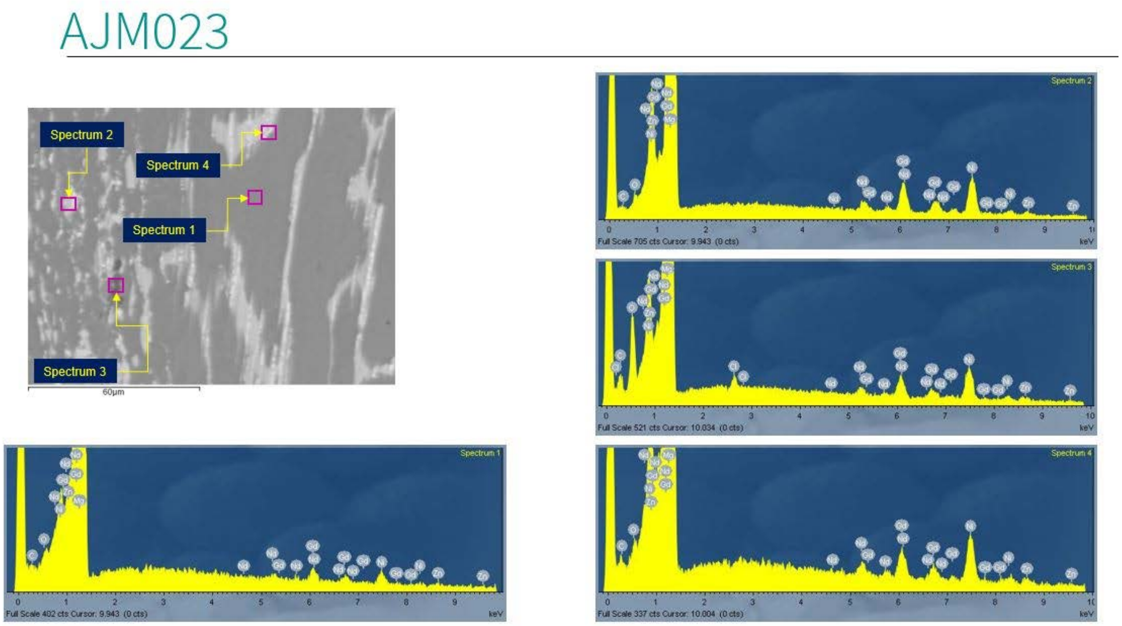


Figure 5. AJM016 SEM and EDS results showing nickel-rich particles in magnesium-zinc alloy matrix

Exponent arranged for elemental analysis testing of each alloy received using inductively coupled plasma-optical emission spectroscopy (ICP-OES). The elemental composition of each magnesium alloy composite was determined.

B. Accuracy and reliability of test methods and test results

All of the testing was conducted in accordance with standard procedures using calibrated/certified instruments and equipment. All testing was conducted in accordance with Exponent's established quality assurance process and an outside testing lab that maintains its ISO 17025 A2LA certification in chemical analysis.

C. Test results

The test results for the elemental compositions are presented in Table 3.

	Elemental Composition (weight %)						
	AJM006	AJM010	AJM012	AJM016	AJM017	AJM018	AJM023
Al	7.59	0.07	0.01	4.04	0.01		0.01
Si							
Zr						0.07	0.02
Y	0.01		0.53	0.02			
Ca			0.02				
Fe							
Ni	0.12	0.17	0.22	0.11	0.11	0.62	2.89
Cu	0.09		0.78	0.06	0.72	0.89	
Nd	0.04			0.06			0.17
Gd	0.03	0.08	0.61	0.07	1.92	0.31	0.45
Zn	0.69	0.01	1.03	0.83	0.02	0.01	0.52
Pb						0.01	
Sn						0.06	
B							
Bi							
Ti							
Co							
Mn	0.15	0.01	0.01	0.08	0.01	0.02	0.01
Mg	Bal	Bal	Bal	Bal	Bal	Bal	Bal

Table 3. Compositions of the seven infringing Ecometal magnesium composites

The dissolution rates are presented in Table 4.

Alloy	Sample ID	Exposure time (hr)	Calculated Corrosion Rate (mg/cm^2*hr)
AJM006-2	#2	6	30.85
AJM010-1	#1	6	36.38
AJM012-1	#1	6	34.47
AJM016-3	#3	6	20.04
AJM017-2	#2	6	39.39
AJM018-3	#3	6	67.06
AJM018-2	#2	3	85.80
AJM023-2	#2	6	Completely Dissolved - Redo
AJM023-1	#1	3	144.87

Table 4. Dissolution rates or corrosion rates (CR); seven infringing Ecometal magnesium composites

All dissolution testing was conducted in 3% KCl at 90°C. All samples were exposed for 6 hours (with exceptions as noted). However, if the dissolution rate (CR) was very high resulting in a large fraction of the sample dissolving, an additional sample was exposed for a reduced time of 3 hours (yellow highlighted).

Metallographic images of the seven accused infringing Ecometal magnesium composites are presented in Exhibit D. View of both the longitudinal cross section and the transverse cross section of each of the extruded Ecometal composites is presented in Exhibit D, for determination of the three-dimensional morphology of the in-situ precipitate particles in each composite.

Microhardness (Vickers 500 gram - HV) measurements were made on each of the seven accused infringing Ecometal magnesium composites. As described in Exhibit E, literature values for both the ultimate tensile strength (UTS) and the Brinell hardness (HB) from a range of wrought magnesium alloys were plotted to determine a functional relationship between the UTS and the hardness. The calculated UTS of the seven Ecometal composites ranged between 29,000 psi (29 ksi) and 63,000 psi (63 ksi). See Exhibit E for the details of this analysis.

D. Conclusions drawn from test results

i. Each of the following Ecometal magnesium composite grades had a base material that is magnesium or a magnesium alloy: AJM006, AJM010. AJM012, AJM016, AJM017, AJM018, and AJM023.

ii. Each of those Ecometal magnesium composite grades also had nickel and/or copper additive, where each of those elements has a melting point temperature that is higher than the melting point temperature of magnesium or the magnesium alloy base material. The melting temperature of pure magnesium is 650 °C while the melting temperature of nickel and copper are 1455 °C and 1084.9 °C, respectively. If processing is conducted at temperatures of greater than 1455 °C for the case of nickel additives and 1084.9 °C for the case of copper additives, the additive materials will melt and become homogenous within the magnesium alloy. The claims provide specific temperature ranges where processing should be conducted to prevent melting of the additive material to form these novel alloy composites.

iii. Each of those Ecometal magnesium composite grades contains a precipitant formed by the additive. All of the AJM alloys examined contain secondary phase particles that are rich in nickel and/or copper. All of these magnesium composites contain >0.05 weight % secondary metal (nickel and copper in this case) that result in the formation of secondary phases that are rich in nickel and/or copper.

iv. Galvanically active intermetallic is a term that is used to describe a secondary phase that has a drastically different electrochemical potential than the

magnesium alloy that results in inducing accelerated galvanic corrosion of the magnesium alloy. The potential difference is the result of the presence of the noble elements in the secondary phase particles. Magnesium alloys are considered to be a reactive metal due to their low natural potential in many environments and illustrated in a galvanic series. Many alloying elements can increase the natural rest potential of magnesium alloy slightly, however, some elements such as copper, nickel, cobalt, and titanium are more noble materials with significantly higher rest potentials. If these elements are present in the form of secondary phase particles, then their large potential difference creates a galvanic or dissimilar metal couple that results in accelerated corrosion of the more active phase (in this case the magnesium alloy). In each of the seven Ecometal magnesium composite grades evaluated, the concentration of copper and/or nickel is low enough and processed in such a manner that the only intermetallic phases that will form are either Mg2Cu or Mg2Ni or a blend thereof, which Hawke et al. has shown to be galvanically active with respect to magnesium and magnesium alloys. The binary phase diagrams for the Cu-Mg system and the Mg-Ni system that demonstrate that conclusion are attached hereto (Ex. F).

v. The size of a plurality of the precipitates in each of the accused Ecometal composites is less than 50 microns, as shown by the micrographs in Exhibit D.

vi. The ultimate tensile strengths of all of accused infringing Ecometal magnesium composites is greater than 14 ksi, and five of the seven accused infringing Ecometal magnesium composites have ultimate tensile strengths within the range of 14 ksi to 50 ksi.

VIII. Infringement Analysis

For the analysis of infringement of the ‘653 Patent, I have attached a claim chart presenting my analysis of the properties of the seven AJM series Ecometal magnesium composite materials compared to the limitations of each of the infringed claims. See Exhibit G.

For each of these seven AJM series Ecometal magnesium composite materials, I find that at least one of the composites infringes 52 claims of the ‘653 Patent. In addition I find that 15 claims of the ‘653 Patent are infringed by all of the seven AJM series magnesium composites tested.

Thus, I conclude that all seven AJM series Ecometal magnesium composite materials literally infringe Terves’ U.S. Patent 10,329,653. I hold this conclusion to at least a reasonable degree of scientific and professional certainty.

For the analysis of infringement of the '740 Patent, I have attached a claim chart presenting my analysis of the properties of the seven AJM series Ecometal magnesium composite materials compared to the limitations of each of the infringed claims. See Exhibit H.

For each of these seven AJM series Ecometal magnesium composite materials, I find that at least one of the composites infringes 87 claims of the '740 Patent. In addition I find that 16 claims of the '740 Patent are infringed by all of the seven AJM series magnesium composites tested.

Thus, I conclude that all seven AJM series Ecometal magnesium composite materials literally infringe Terves' U.S. Patent 10,689,740 either directly or indirectly. I hold this conclusion to at least a reasonable degree of scientific and professional certainty.

If necessary, I reserve the right to consider infringement under the Doctrine of Equivalents.

IX. Analysis of Dr. Medlin's Infringement Opinion

Referring to my report of August 6, 2020, Dr. Medlin has only challenged the infringement of Ecometal composites AJM006, AJM010, AJM012, AJM016, AJM017, AJM018 and AJM023 under Claim 19 of the '740 Patent, and only with respect to one of the claim limitations in Claim 19:

> " a plurality of particles of said in situ precipitate having a size of no more than 50 µm, ".

With no experimental or laboratory analysis of his own, Dr. Medlin speculates that the dense particles appearing light-colored in the back-scatter electron composition scanning electron microscope (SEM) micrographs in my August 6, 2020 report are not in situ precipitates formed by the additive materials copper and/or nickel and instead speculates that these may be inclusions. I have addressed this critique in my deposition transcript of October 12, 2020 and my second rebuttal report dated November 20, 2020 by noting that given the elemental composition of the accused Ecometal magnesium composites, thermodynamics, including the information on the relevant binary phase diagrams, dictates that the light colored, dense phases must by Mg_2Cu or Mg_2Ni, or a combination thereof. I also addressed the speculation that the light colored phases might be "debris or dross." I noted that the oxides of the most active components, magnesium, aluminum and zinc, which would be the major constituents of any dross that might have been incorporated into the Ecometal magnesium composites, would have a lower molecular weight than the magnesium alloy matrix. These oxide particles, if present, would show up in SEM images as dark contrast particles instead of the as light contrast phase particles due to their lower atomic number.

Dr. Medlin also speculates that the three-dimensional shape of the light colored particles in my SEM micrographs might have a dimension perpendicular to the plane of the micrographs that was substantially larger than the two dimensions portrayed in the micrographs. Again, basic thermodynamics proves that this is not the case, in that the precipitation and growth of the in situ

precipitates is in a morphology that minimizes the interfacial energy of the particles, making equi-axed or nearly spherical particles the thermodynamically preferred morphology. In the presented SEM micrographs where a preferred directionality is observed, the size of the light colored phase particles in the direction perpendicular to the plane of the micrograph would again be constrained by thermodynamics to be approximately the same as the transverse dimension of the particles in the two-dimensional view present in the micrographs, except as influenced by the extrusion process. The textbook by Reed-Hill confirms these thermodynamic constraints on particle morphology in the chapters on precipitation hardening (Chapter 9) and on nucleation and growth (Chapter 13).

Dr. Medlin is incorrect in his assertion that I considered only one limitation of one claim of the '740 Patent. The charts attached to my August 6, 2020 report - Exhibits "B" through "I" - show that every limitation of every asserted claim of the '740 Patent that I considered is met by each of the seven accused Ecometal magnesium composites.

A POSITA as defined in my prior reports would have the understanding of basic thermodynamics from an undergraduate textbook such as Reed-Hill's ***Physical Metallurgy Principles*** and would recognize from the micrographs, the elemental analyses, and the dissolution rates that the seven accused Ecometal magnesium composites would infringe the asserted claims of the '740 Patent.

Additionally, it is interesting to note that in paragraph 20 of his October 15, 2020 Supplemental Declaration, Dr. Medlin states:

> "First, Dr. Swanger did not establish that the alleged in situ precipitate, which Dr. Swanger contends appears in the images at pp. 6-10 of his August 6, 2020 supplemental report, were formed by **the additive material, e.g. copper or nickel**, as required by claim 19 of the '740 Patent." (emphasis added)

Therein Dr. Medlin does acknowledge that the additive material as defined in the Terves Patents, can be copper or nickel, and does not need to be a master alloy.

I have also attached in Exhibit D micrographs of the seven accused Ecometal magnesium composites showing metallographic cross sections in both the longitudinal and transverse directions of the extruded magnesium composites. These micrographs show that every one of the seven accused Ecometal magnesium composites has a plurality of in situ precipitates having a size of no more than 50 micro-meters (microns), no matter what orientation is considered.

X. Methodology

The methodology I used to arrive at my opinions is accepted in the scientific community and is appropriate for reaching scientifically reliable conclusions such as those stated and discussed in this report. This methodology includes the following:

(1) reviewing and considering information from available sources, including documents produced by the parties, as well as other information referred to throughout this report and the exhibits thereto;

(2) informing myself regarding relevant aspects of patent law through discussions with counsel for Terves; and

(3) applying my education, training and experience to analyze the issues I was asked to consider.

X. Supplementation

While the opinions set forth in this rebuttal report are complete, I reserve the right to further supplement this report and the underlying April 28, 2020, May 4, 2020, August 6, 2020, October 6, 2020, and November 20, 2020 reports and any of the opinions expressed herein and therein respectively, should I receive additional information or evidence that is relevant to those opinions between now and the time that I testify at deposition or trial. Moreover, I reserve the right to serve one or more additional expert reports in this litigation if requested to do so, and I reserve the right to supplement the opinions set forth herein as part of such additional expert reports in order to account for additional information or evidence that is learned or developed before any such additional report is prepared.

XI. Attestation

By affixing my signature and seal below, I certify that this report, and my three prior reports of April 28, 2020, May 4, 2020, August 6, 2020, October 6, 2020, and November 20,2020 as well as my two deposition transcripts truthfully present the results of my analyses, and the conclusions and opinions, which I hold to at least a reasonable degree of scientific and engineering probability, that I have reached based on those analyses. If called on to present testimony on these issues, conclusions, and opinions, I will testify completely and truthfully to my conclusions and opinions. Subject to the penalty for perjury under United States of America laws, I declare that the foregoing is true and correct.

Respectfully submitted,

Lee A. Swanger, Ph.D., P.E.
Principal Engineer, Exponent, Inc.
July 27, 2021

Exhibit A

Exponent®
Engineering & Scientific Consulting

Lee A. Swanger, Ph.D., P.E.

Principal Engineer & Office Director | Materials & Corrosion Engineering
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(305) 661-1000 tel | lswanger@exponent.com

Professional Profile

Dr. Swanger is the Director of Exponent's Miami, Florida, office. His consulting work centers on the application of the principles of mechanical engineering, metallurgical and materials engineering, thermodynamics, and design engineering to issues related to incidents involving performance of engineered products and systems, accident reconstruction, and failure or fracture of system components. He also consults on issues of patent infringement and patent validity in the mechanical and materials arts. More specifically, Dr. Swanger's experience includes the analysis of machinery dynamics and kinetics as exemplified by internal combustion engines of both piston and turbine configuration, as well as related compressor designs. His materials and metallurgical experience includes alloy applications, heat treatment, electrochemistry and corrosion, welding and brazing, and materials testing. He applies his combined expertise in both mechanical engineering and materials/metallurgical engineering to issues of fatigue and fracture, and mechanical joining via threaded fasteners.

Applications of these disciplines include systems in nuclear and fossil power plants, components of transportation systems on land, sea, and air, industrial manufacturing processes, components of commercial and residential buildings, materials used in the petroleum and chemical industries, machinery and processes for vapor degreasing and dry cleaning, and consumer products including sports equipment and kitchen appliances.

Dr. Swanger has a particular interest in engine design and performance, with an emphasis on combustion, operational stresses, lubrication and bearing design and performance. He received a U.S. Patent for his engine bearing material and fabrication process.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, Stanford University, *with distinction*, 1972

M.B.A., Marketing/Finance, Cleveland State University, 1982

M.S., Materials Science and Engineering, Stanford University, 1969

B.S., Metallurgy, Case Institute of Technology, *with highest honors*, 1968

Hertz Foundation Graduate Fellowship, 1970-1972

Member, Board of Directors of the Fannie and John Hertz Foundation

Licenses and Certifications

Licensed Professional Engineer, Alabama, #29848-E

Licensed Professional Mechanical Engineer, California, #M23275

Licensed Professional Engineer, Florida, #37207

Licensed Professional Engineer, Georgia, #PE036205

Licensed Metallurgical Engineer, Louisiana, #34064

Licensed Professional Engineer, Mississippi, #25349

Licensed Professional Engineer, New York, #93691

Licensed Professional Metallurgical Engineer, Ohio, #44024

Licensed Professional Engineer, Virginia, #15492

Licensed Mechanical Engineer, Wyoming, #11899

Prior Experience

Adjunct Professor, Mechanical Engineering Department, University of Miami, 1999-2008

Director of Research and Development, Engine Parts Division, Imperial Clevite, 1979-1983

Lecturer, Mechanical Engineering Department, Cleveland State University, 1978-1982

Project Manager, Gould Labs for Materials Research, Gould Inc., 1975-1979

Associate Sr. Research Metallurgist, General Motors Research Labs, 1973-1975

Patents

Patent 4,333,215: Bearing Material and Method of Making, issued June 8, 1982.

Publications

Rogers G, Swanger L, Wells C. The Role of testing programs in verifying structural integrity of medium speed diesel generator components. Institute for Electrical and Electronics Engineers Transaction on Nuclear Science 1985; NS-32(1), February.

Swanger L. Inhomogeneous thermodynamics and spinodal decomposition. Ph.D. Dissertation, Stanford University, August 1972.

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Swanger L, Harris D, Johnston P, Derbalian G. Advanced methods for diesel component life prediction. Society for Automotive Engineers Paper 860885, Marine Propulsion Technology Conference, Washington, DC, May 1986.

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Rogers G, Wells C, Swanger L. Design analysis of emergency diesel generator components to establish reliability under operating conditions. 8th International Conference on Structural Mechanics in Reactor Technology, Brussels, Belgium, August 1985.

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Swanger L. Heavy duty bearings: Materials and process. Presented at Carnegie-Mellon University, Pittsburgh, PA, March 1980.

Reports

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Swanger L. Rule 26 Report of Lee A. Swanger In the Matter of Innovative Fuel Products, LLC vs. BP Products North America Inc., December 23, 2010.

Swanger L. Report of Lee A. Swanger In the Matter of Questar Gas Management Co. v. Waukesha and Stewart & Stevenson, March 13, 2009.

Swanger L. Expert Report of Lee A. Swanger, Ph.D. P.E. Regarding Invalidity of U.S. Patent No. 6,979,117 and U.S. Patent No. 7, 281,842, K-TEC, Inc. vs. Vita-Mix Corporation, January 15, 2010.

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Swanger L. Response to Expert Report of Michael Thuma Pursuant to Rule 26(A)(2)(B) By Lee A. Swanger, Ph.D., P.E., Sunbeam Products, Inc. d/b/a Jarden Consumer Solutions vs. Homeland Housewares, LLC, et al., Case No. 3:09-CV-00791 REP, October 18, 2010.

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Exhibit B

Complaint, Case No. 1:19-cv-1611-DCN

U.S. Patent 9,903,010

U.S. Patent 10,329,653

U.S. Patent 10,689,740

Protective Order, Case No. 1:19-cv-1611-DCN

Ecometal answers to Interrogatories

Ecometal and Yuan Preliminary Claim Constructions and Evidence

Terves' Preliminary Claim Constructions and Evidence

Declaration of Dr. Dana J. Medlin, Ph.D., P.E., FASM Addressing Proposed Claim Terms to be Construed and Proposed Constructions

Declaration of Andrew Sherman

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Hanawalt et al., "Corrosion Studies of Magnesium and its Alloys" AIME Metals Technology, Technical Paper 1353 (1941)

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ASM Metals Handbook, Tenth Edition, Volume 3 "Alloy Phase Diagrams" (1993)

Magnesium composite billets from Ecometal:
AJM006, AJM010, AJM 012, AJM016, AJM017, AJM018, AJM023,
MD-CAST, MM3, SD-CHST

Magnesium composite billets from Terves:
TAX100E-1, TAX100E-2, TAX100E-3, TAX HDD-1, TAX HDD-2

Supplemental Declaration of Dr. Dana J. Medlin dated October 15, 2020 including the Exhibits thereto

Physical Metallurgical Principles – Second Edition by Robert E. Reed-Hill, McGraw-Hill, 1973.

Exhibit C

FaAA Project	CASE #	LITIGANTS	SUBJECT OF TESTIMONY	P or D	COUNSEL	JURISDICTION	VENUE	DATE OF TESTIMONY
1609531	01-15-004-9938	GE Transportation Consolidated Precision Products	Metallurgical and Mechanical Engineering	P	John Scalzo Brian Rose	American Arbitration Assoc. Int'l Centre for Dispute Resol.	Cleveland, OH	4/24/2017
1605143	3:15-13328	Sigman, et al. CSX Transportation Sperry Rail Service	Metallurgical Engineering	 D D	D. Blayne Honeycutt Robert Massie John D. "Jack" Hoblitzell, III	U.S. District Court	Southern District of West Virginia Huntington Division	2/2/2018
1701076	CV-2017-900038	Pettway Vac-Con, Inc., et al.	Materials Engineering	 D	Robert Mitchell Michael Truncale	Circuit Court	Mobile County Alabama	2/19/2018
1708681	2012-CA-011871-O	Rutledge Probus Online, Inc.	Mechanical Engineering	P	W. Andrew Rariden Michael J. Merrill	Circuit Court 9th Judicial Circuit	Orange County Florida	4/5/2018
1705741	2016-03483	Sandbox Logistics Arrows Up, Inc	Materials Engineering Mechanical and	 D	Matthew P. Whitley Stephen Loftin	Texas State Court 334th Judicial District	Harris County Texas	4/18/2018
1804105	8:16-CV-1241-T-17JSS	Lidey Luehrs' Ideal Rides, Inc.	Mechanical Engineering	 D	Jonathan D. Rubinstein James R. Brown	U.S. District Court	Middle District of Florida Tampa Division	6/6/2018
1705741	2016-03483	Sandbox Logistics Arrows Up, Inc.	Mechanical and Materials Engineering	 D	Matthew P. Whitley Stephen Loftin	Texas State Court 334th Judicial District	Harris County Texas	6/28/2018 T
1801641	16-02709-MD-W-GAF	Browning Dollar General Corp.	Mechanical and Metallurgical Engineering	 D	Ryan Casey R. Trent Taylor	U.S. District Court	Western District of Missouri Missouri	7/18/2018
1708681	2012-CA-011871-O	Rutledge Central Florida Injury Probus Online	Mechanical Engineering	P	Andy Rariden Ronald Harrop Michael Merrill	Florida State Court Ninth Judicial Circuit	Orange County Florida	10/23/2018 T
1904058	BC 646594	Mamdouh Habib RR Street	Mechanical Engineering	 D	Raphael Metzger John Thomas	California Superior Court Los Angeles Central District	Los Angeles, CA	6/20/2019
1903771	18-009614	Akif Ali GeoVera Specialty Insurance	Metallurgical Engineering	 D	Geoffrey Gilbert Karen Brimmer	Circuit Court 17th Judicial Dstrt Broward County, FL	Broward County, FL	8/23/2019
1505127	2017-025835-CA-01	D Miami Investment Inc. NCH Pumbing, Inc.	Mechanical Engineering Materials Engineering	 D	Natasha Rivera Alexander Alvarez	Circuit Court 11th Circuit Miami-Dade County, FL	Miami, FL	9/6/2019
1907404	1:19-cv-01611-DCN	Terves LLC Yueyang Aerospace & Ecometal	Metallurgical Engineering Patent Infringement	P	David Cupar Evan Talley	US District Court Northern Ohio Eastern District	Cleveland, OH	June 3, 2020
1907404	1:19-cv-01611-DCN	Terves LLC Yueyang Aerospace & Ecometal	Metallurgical Engineering Patent Infringement	P	David Cupar Evan Talley	US District Court Northern Ohio Eastern District	Cleveland, OH	12-Oct-20

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FaAA Project	CASE #	LITIGANTS	SUBJECT OF TESTIMONY	P or D	COUNSEL	JURISDICTION	VENUE	DATE OF TESTIMONY
2008119	20-cv-21586-JEM	Milner Scottsdale Insurance	Metallurgical Engineering	D	Maximo Santiago Joseph Miele	U S District Court - Florida Southern District	Miami-Dade County	2/9/2021
1707055	CACE 18 - 026778 CACE 18 - 026917	Hollinger and McKenzie Qualitiy Steel Corporation	Metallurgical Engineering	D	Joseph Slama Robin Rothman	17th Judicial Circuit Broward County, Florida	Broward County FL	2/22/2021
2002150	CGC-98-999345 and CGC-98-999643	City of Modesto, CA DOW and PPG	Mechanical and Materials Engineering	D	Duane Miller Genaro Filice	State of California County of San Francisco	County of San Francisco	5/6/2021
1600068	5:14 - CV-01872-DSF	Betty Goldberg & Al Goldberg Goss-Jewett Co.	Mechanical and Materials Engineering	P	Bret Stone Chris Johnson	U S District Court - California Central District	Santa Barbara, CA	5/18/2021 T
1809042	18-003983 CA 01	Jesus Carbonell, Jr. Alvaco Enterprises, Inc.	Mechanical Engineering	D	J.C. Gonzalez Anthony Torrente	11th Judicial Circuit Miami-Dade County	Miami-Dade Cty, Florida	6/11/2021
1908910	2:18-cv-00456	Eric Stevens et al. Class Action Ford Motor Company	Mechanical Engineering Materials - Tribology	D	Lauren Akers Cole Geddy	US District Court - Texas Southern District	Corpus Christi Division	6/29/2021
1705257	6:18-CV-00213	Stone Energy Corp. Nippon Steel and Sumitomo	Materials - Corrosion	P	Matt Jones Meghan Senter	US District Court - Louisiana Western District	Lafayette Division	7/20/2021

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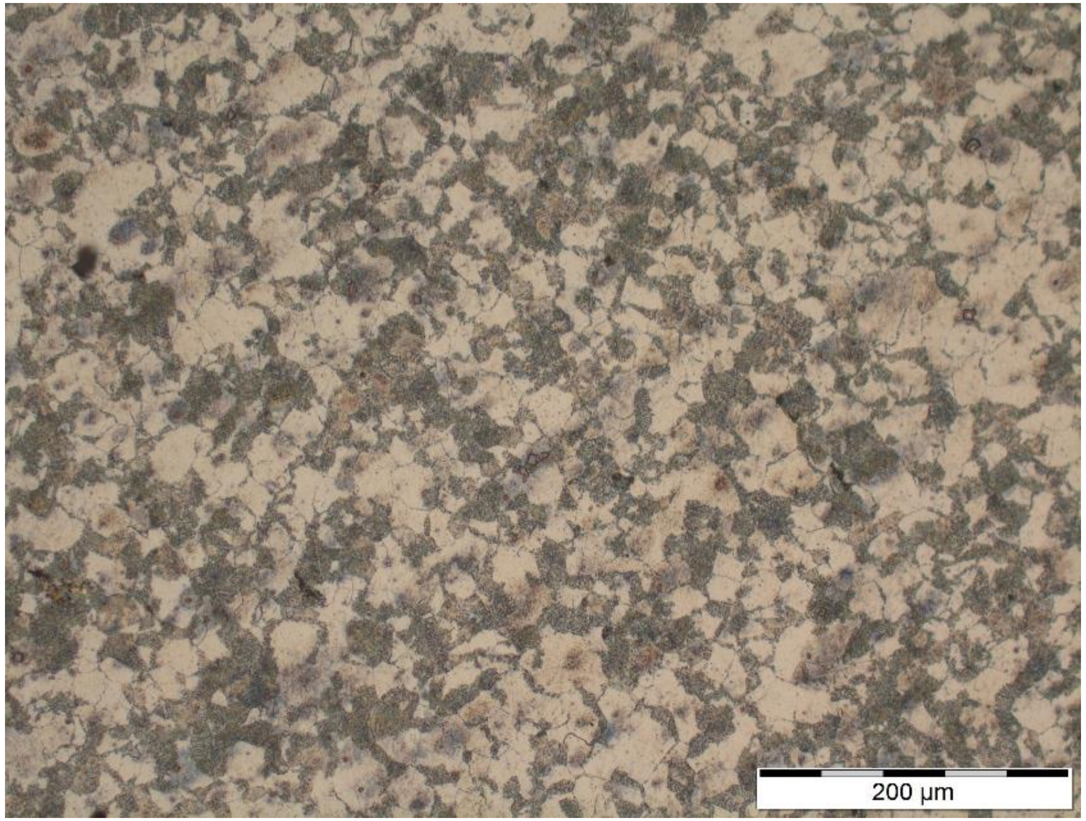
Exhibit D

Exponent®

Terves v Ecometals – Summary of Optical Microscope Observations

July 2021

AJM006 Transverse



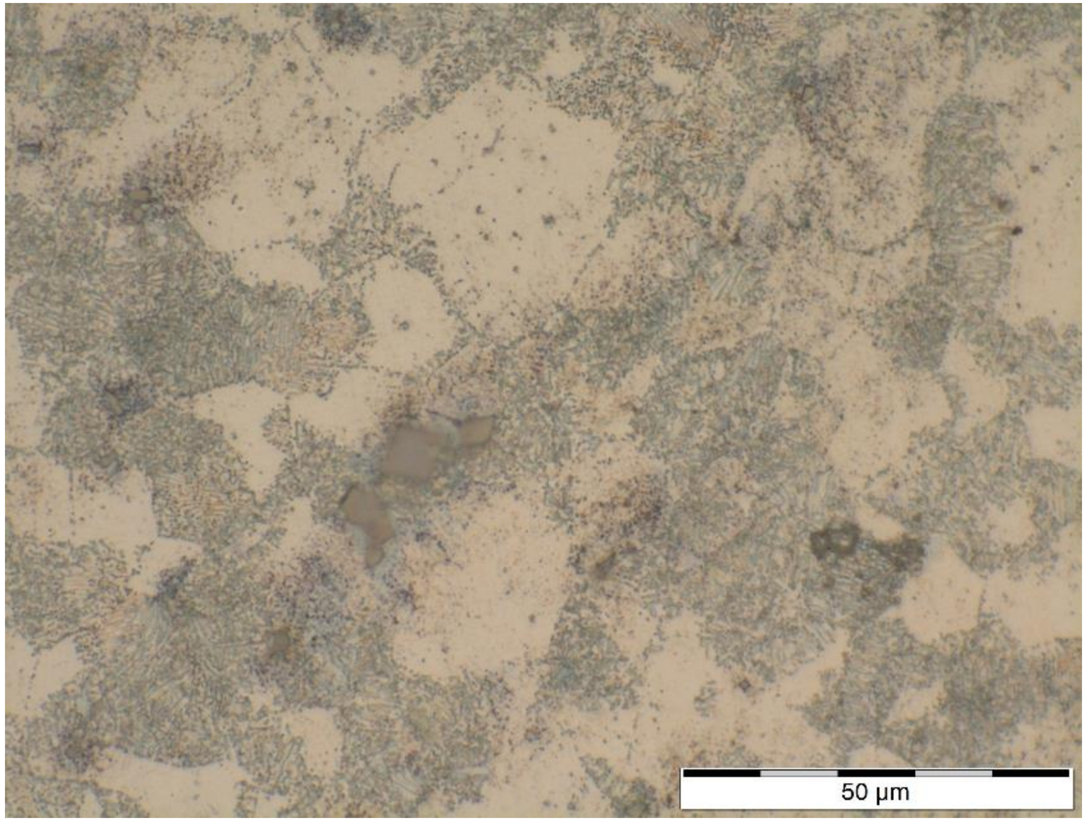


EXHIBIT 2
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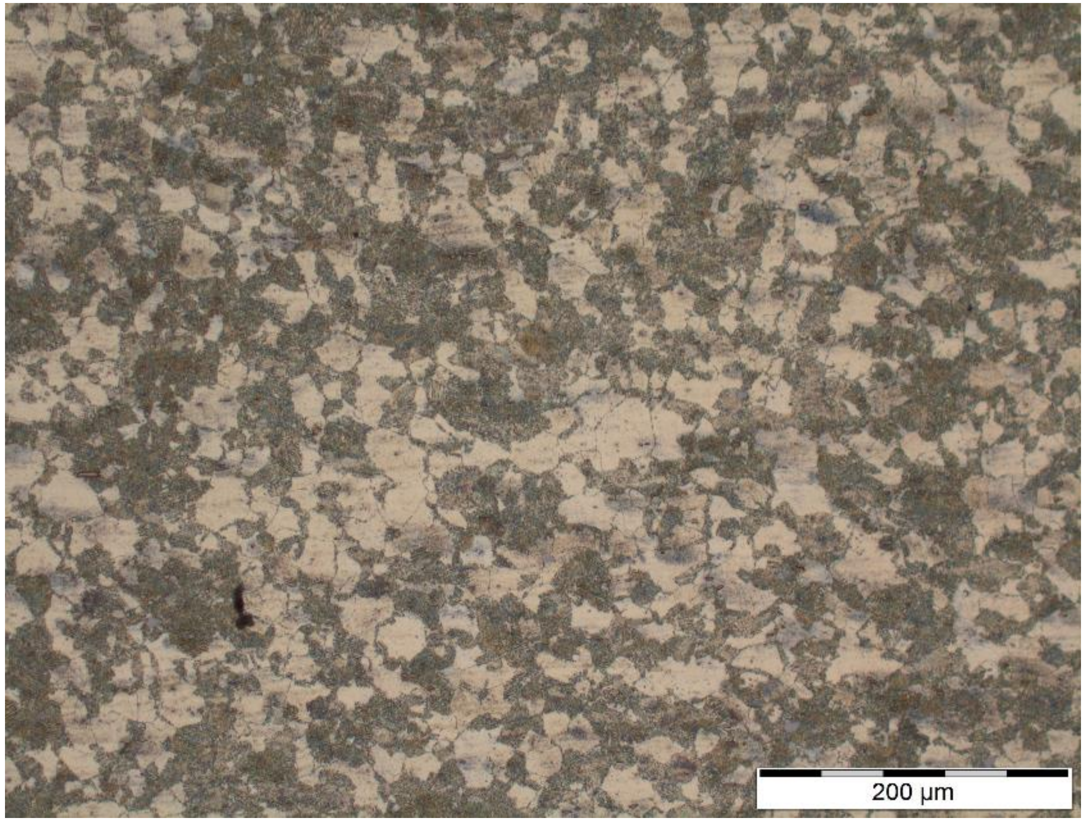
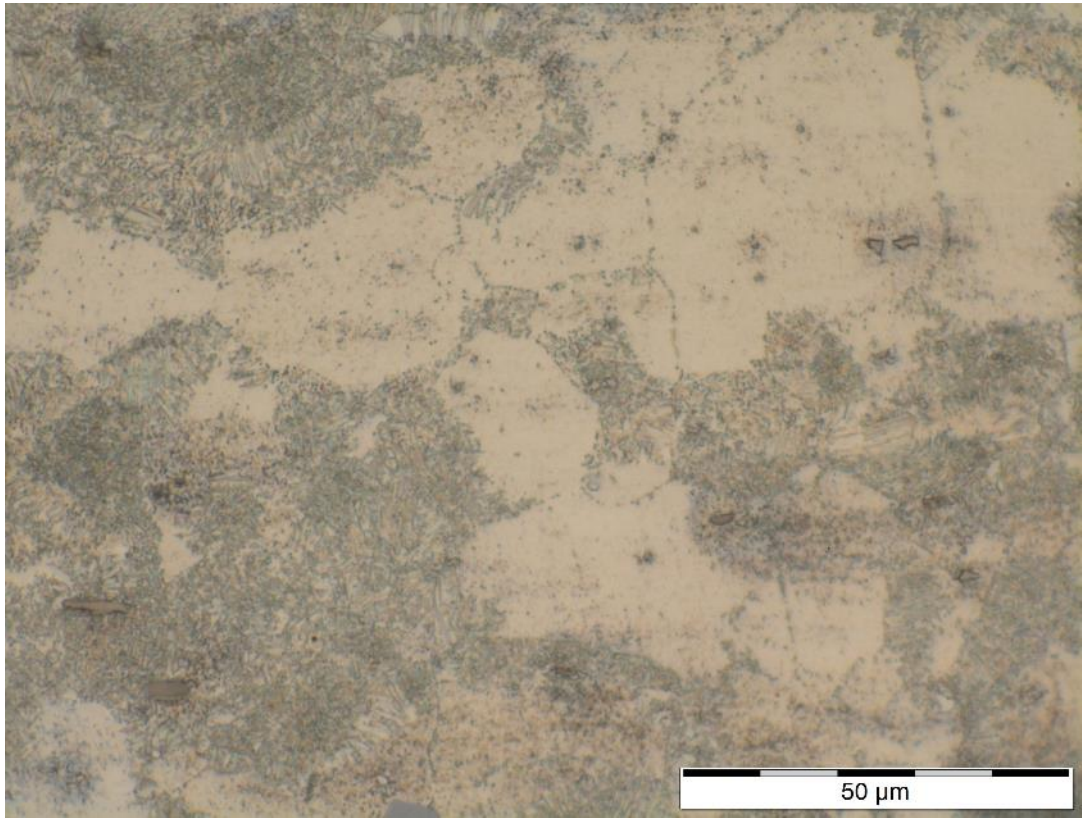
AJM006 Longitudinal





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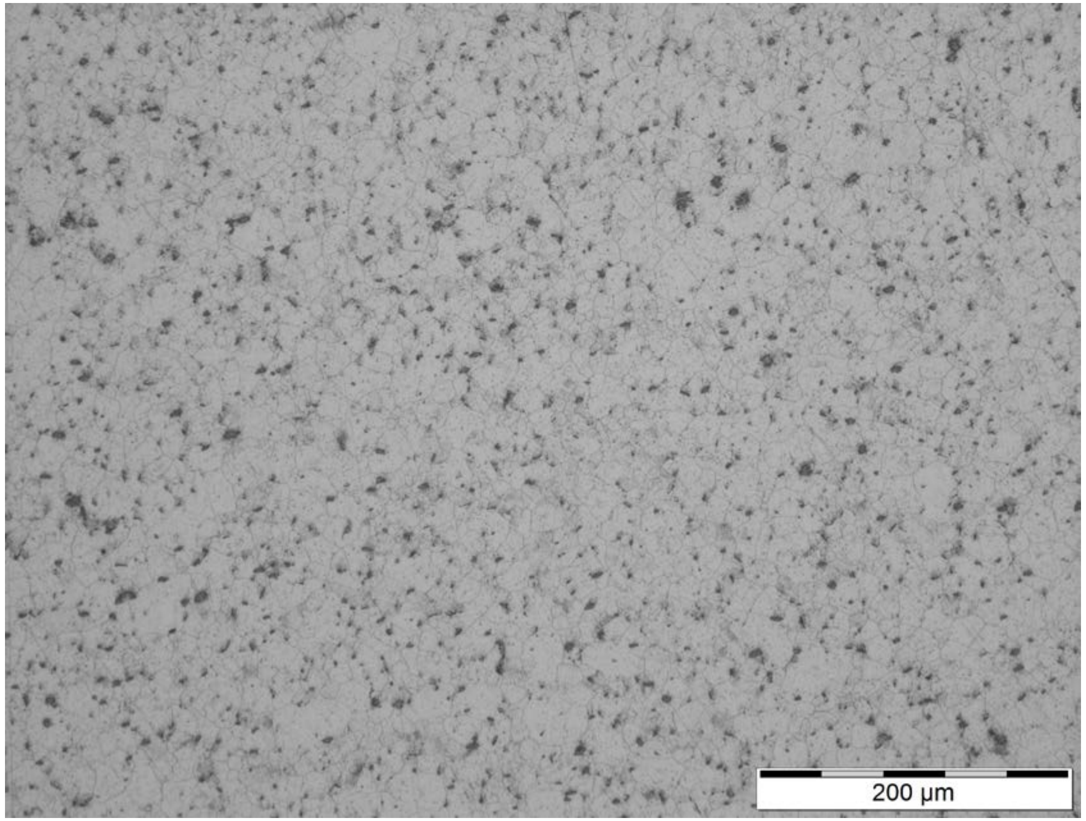
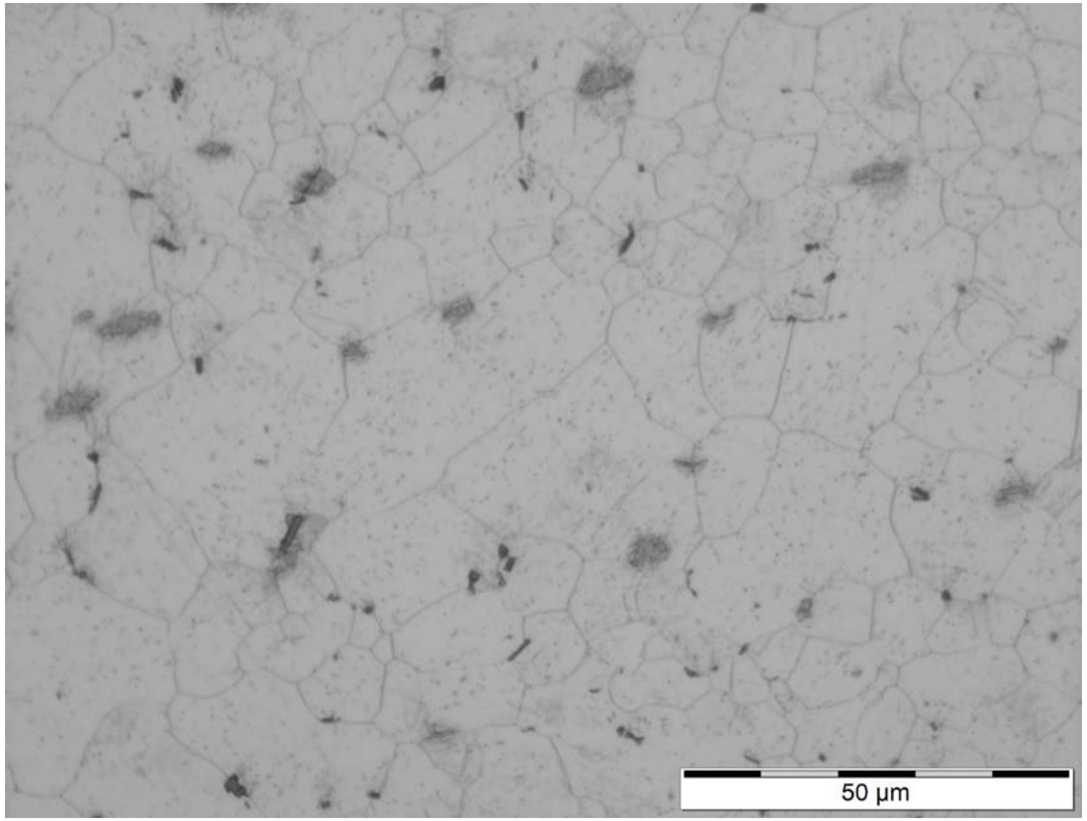
AJM010 Transverse





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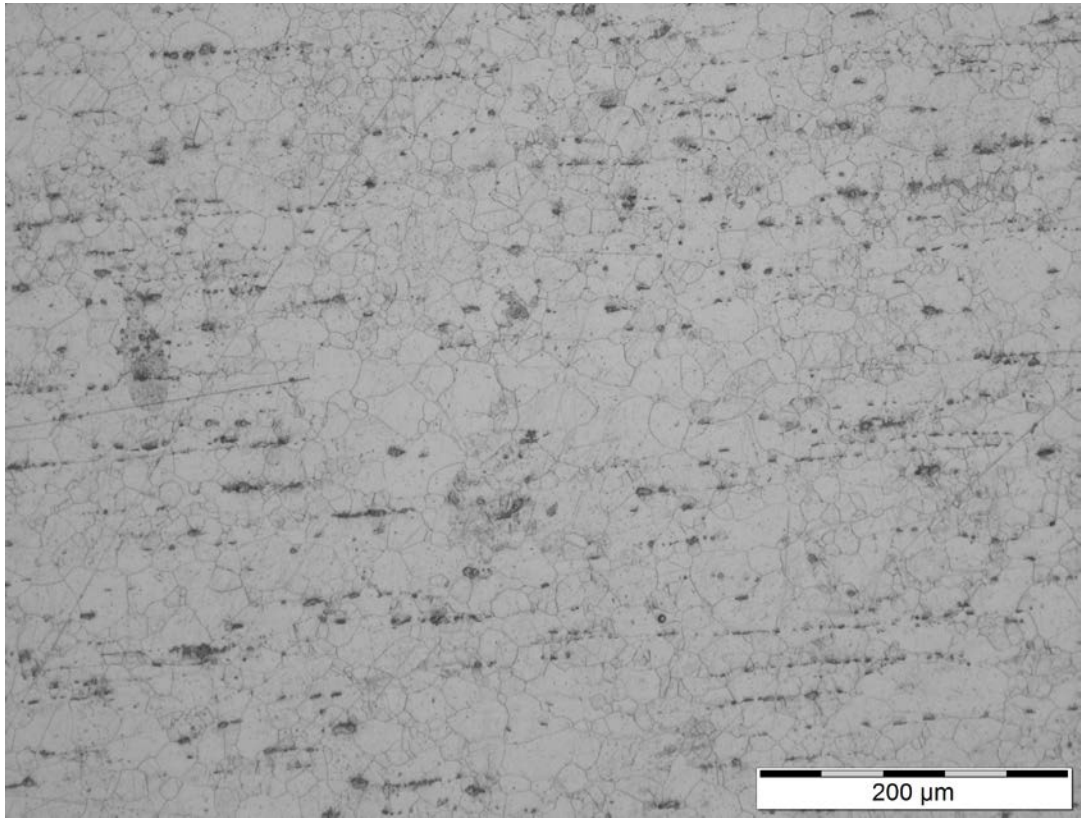
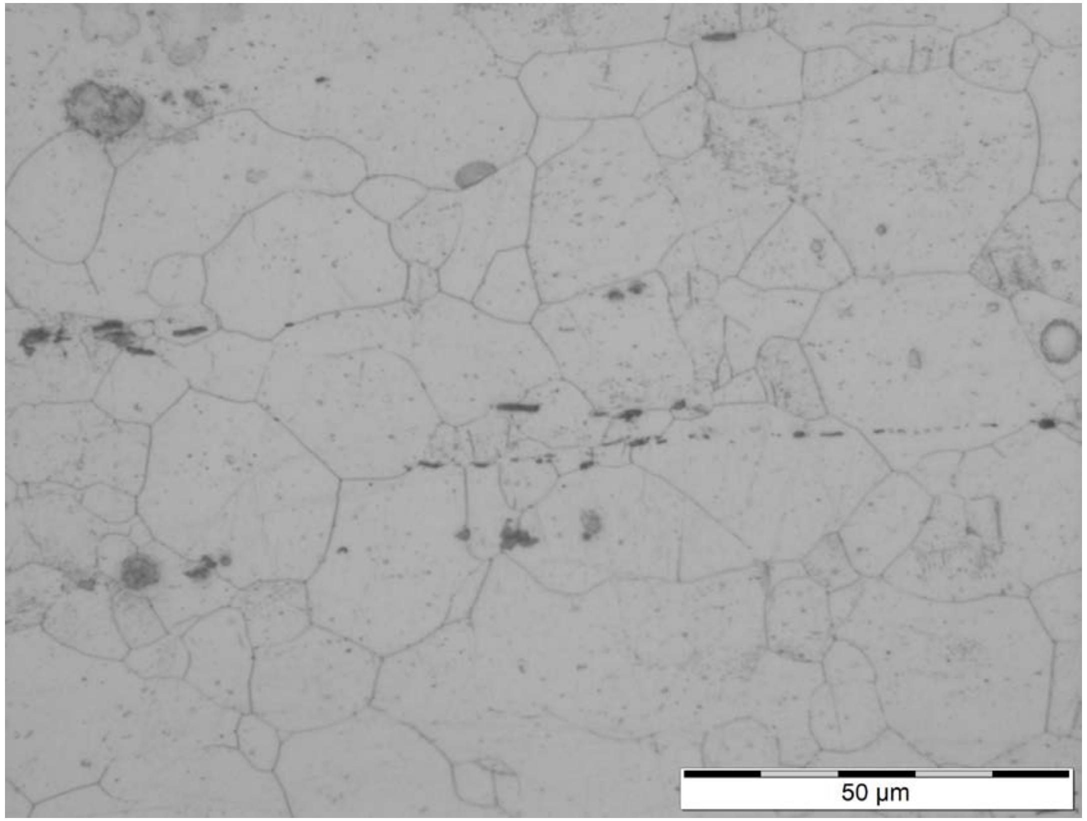
AJM010 Longitudinal





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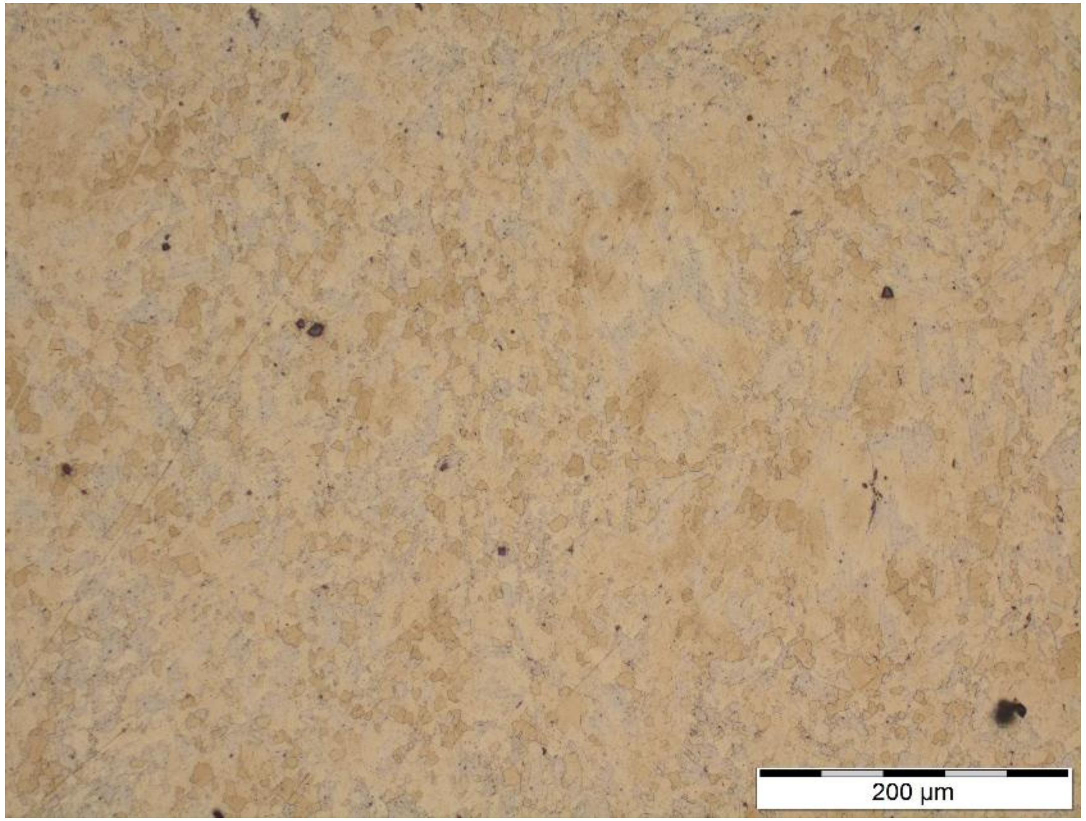
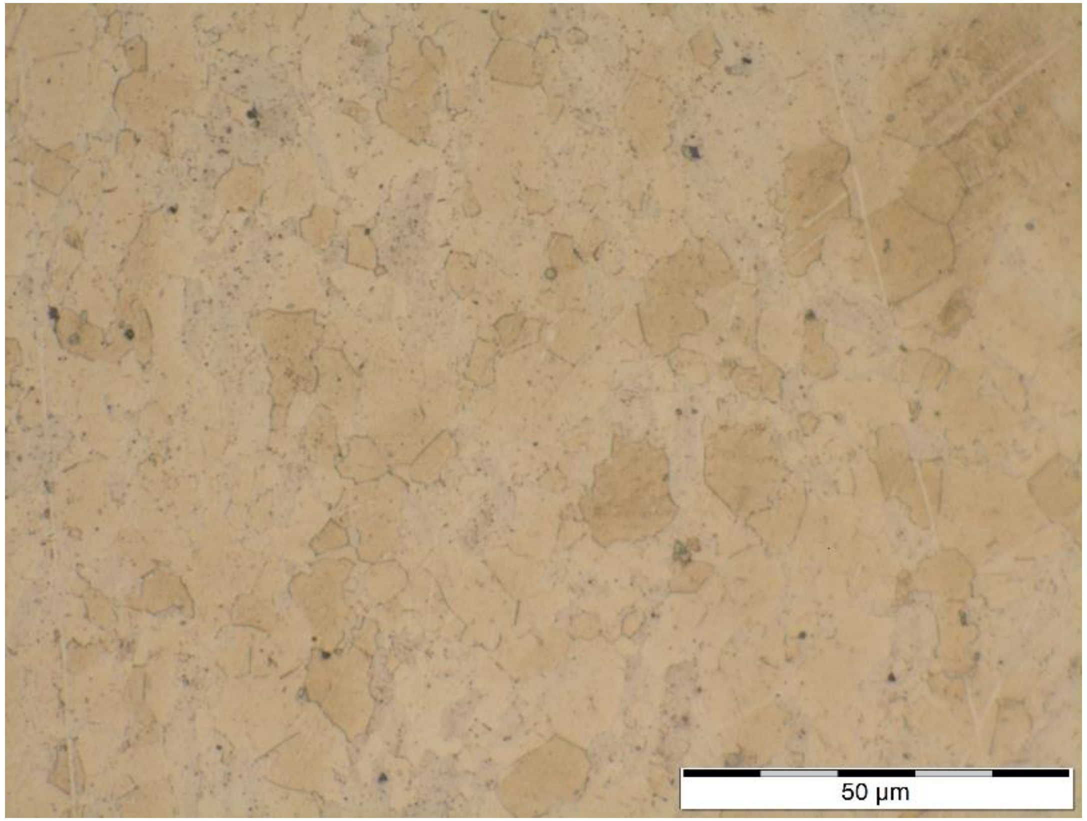
AJM012 Transverse





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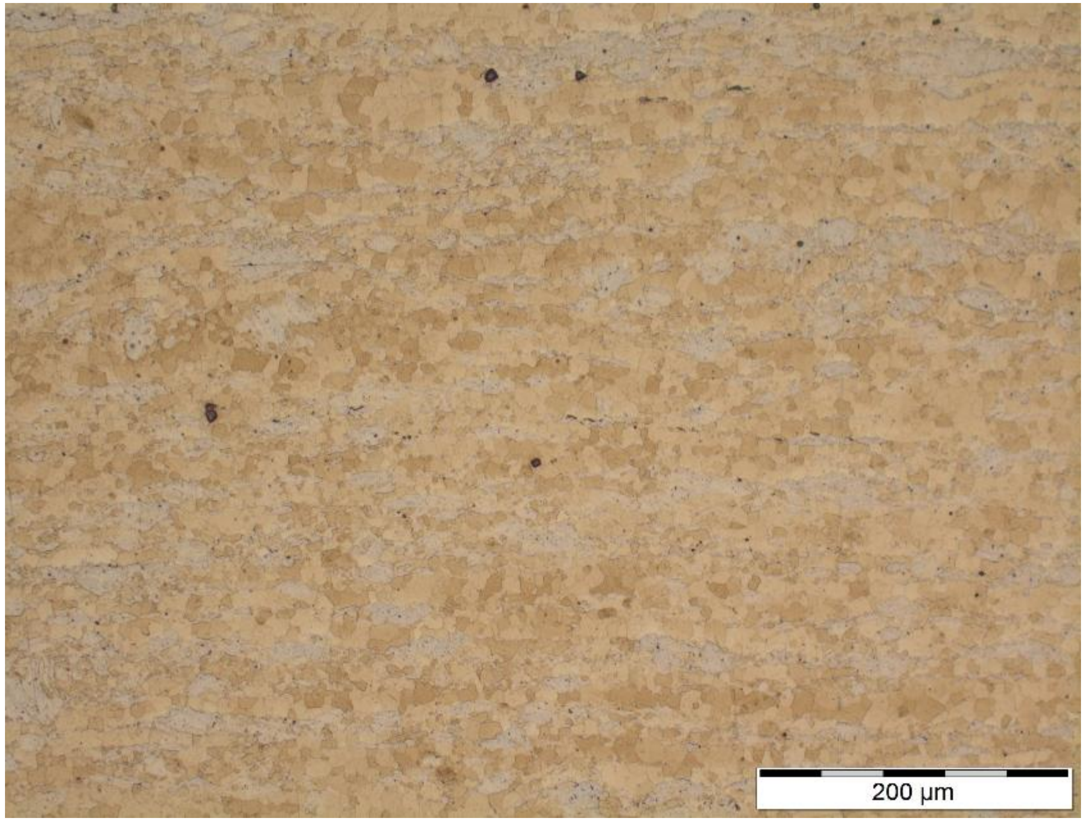
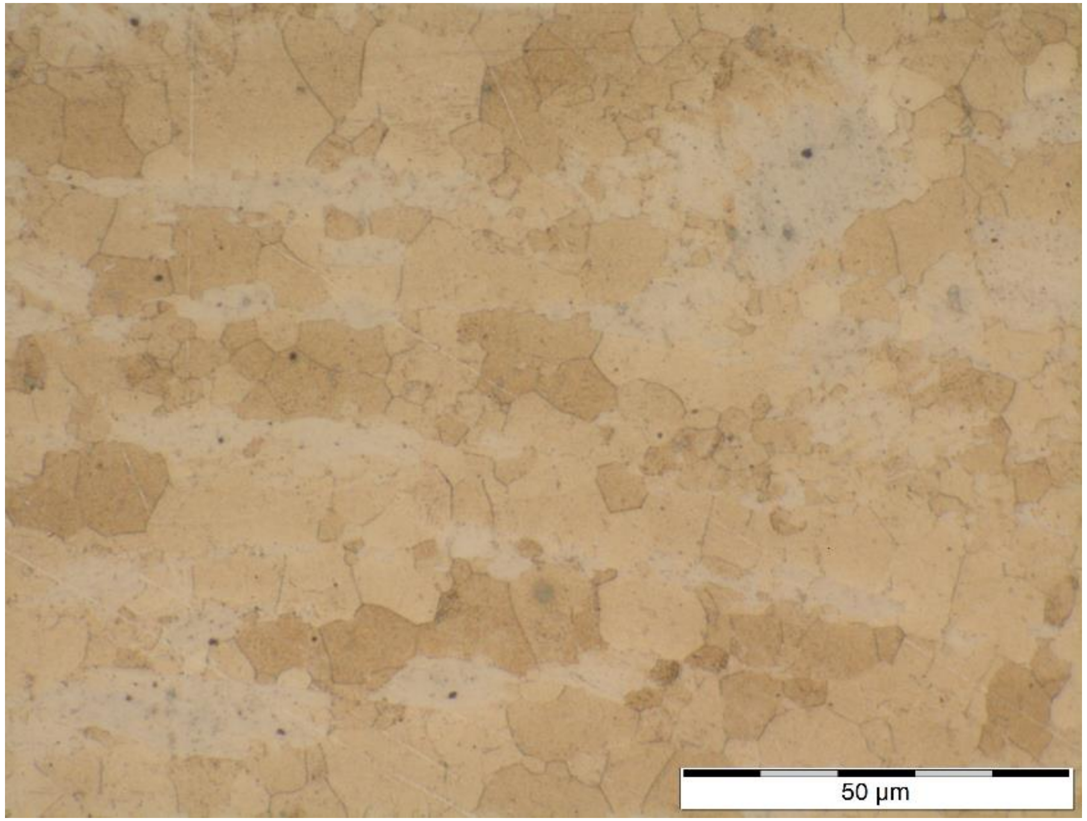
AJM012 Longitudinal





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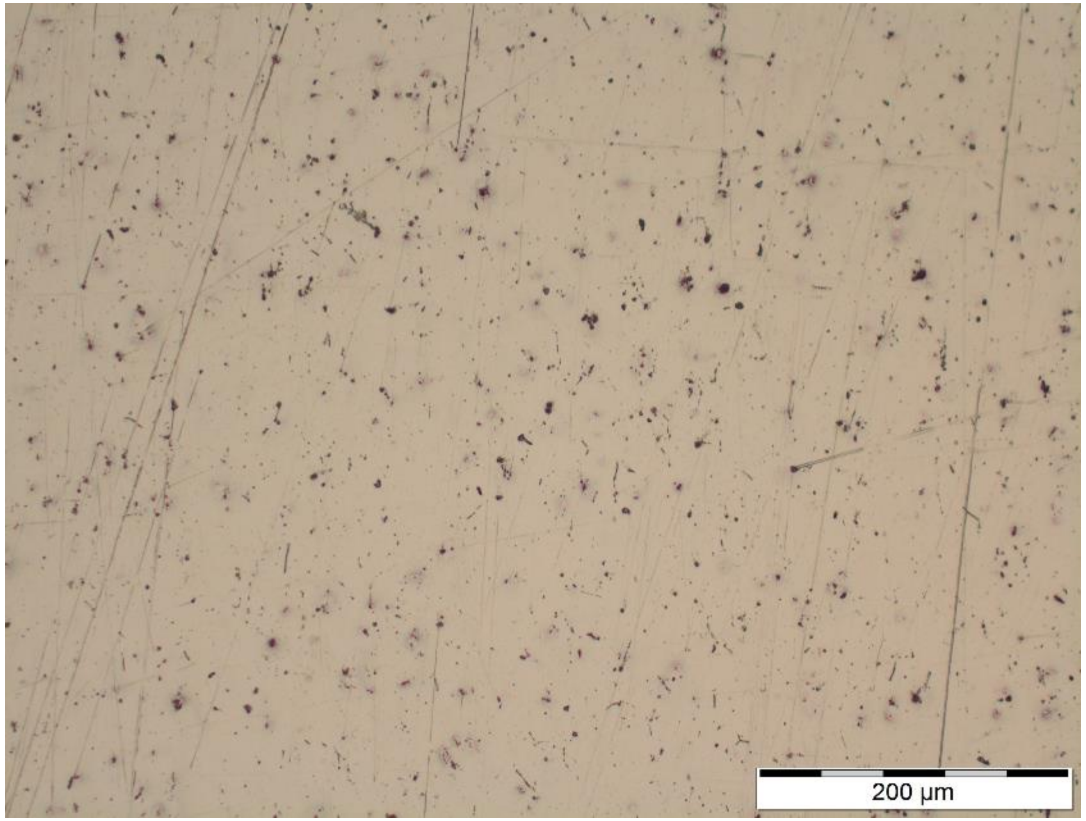
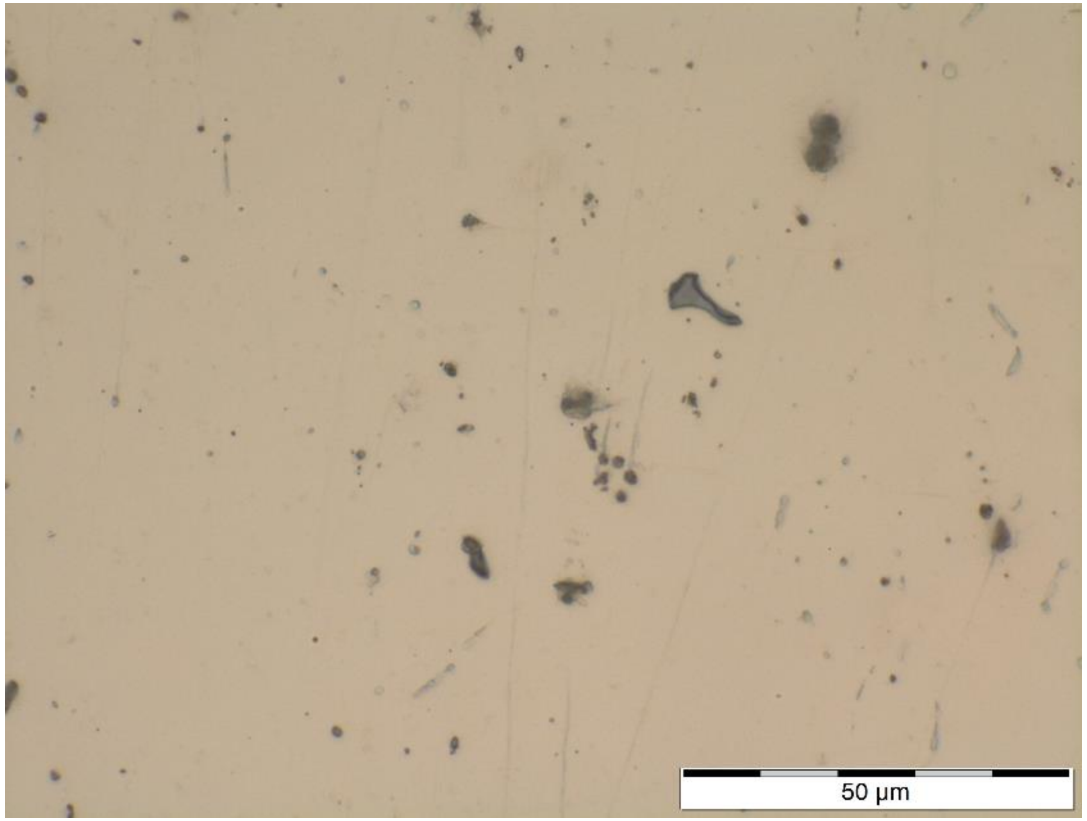
AJM016 Transverse





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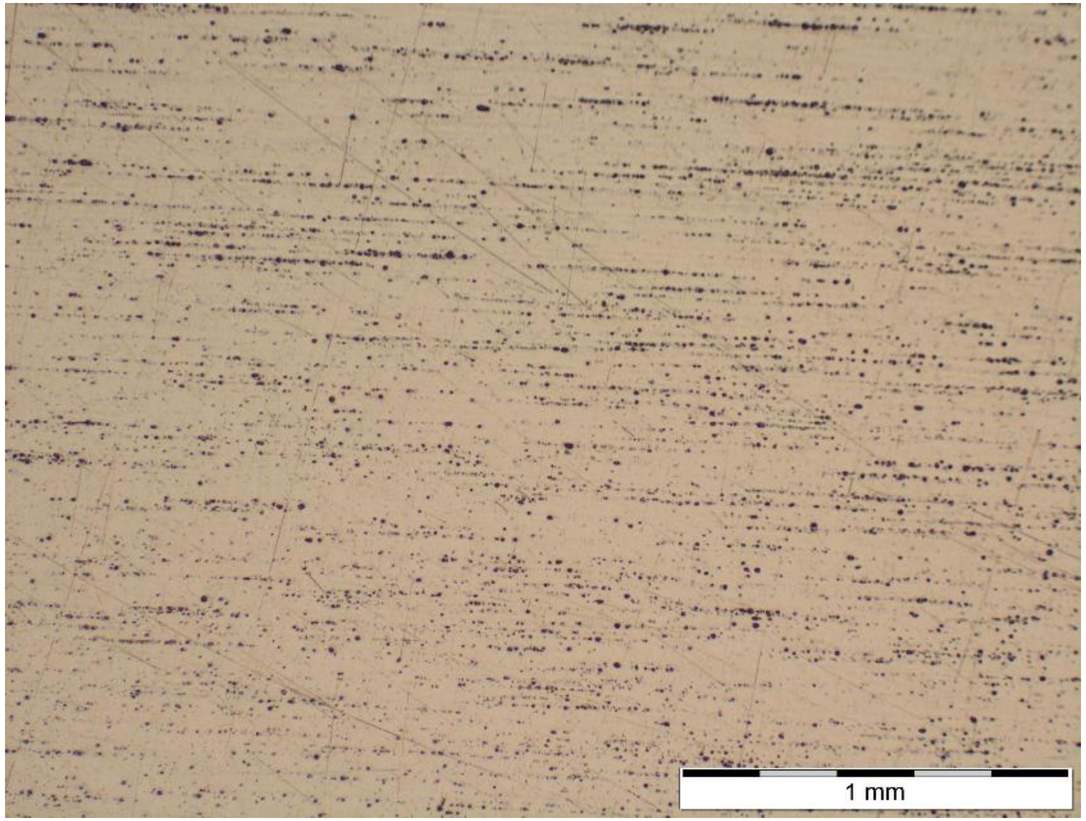
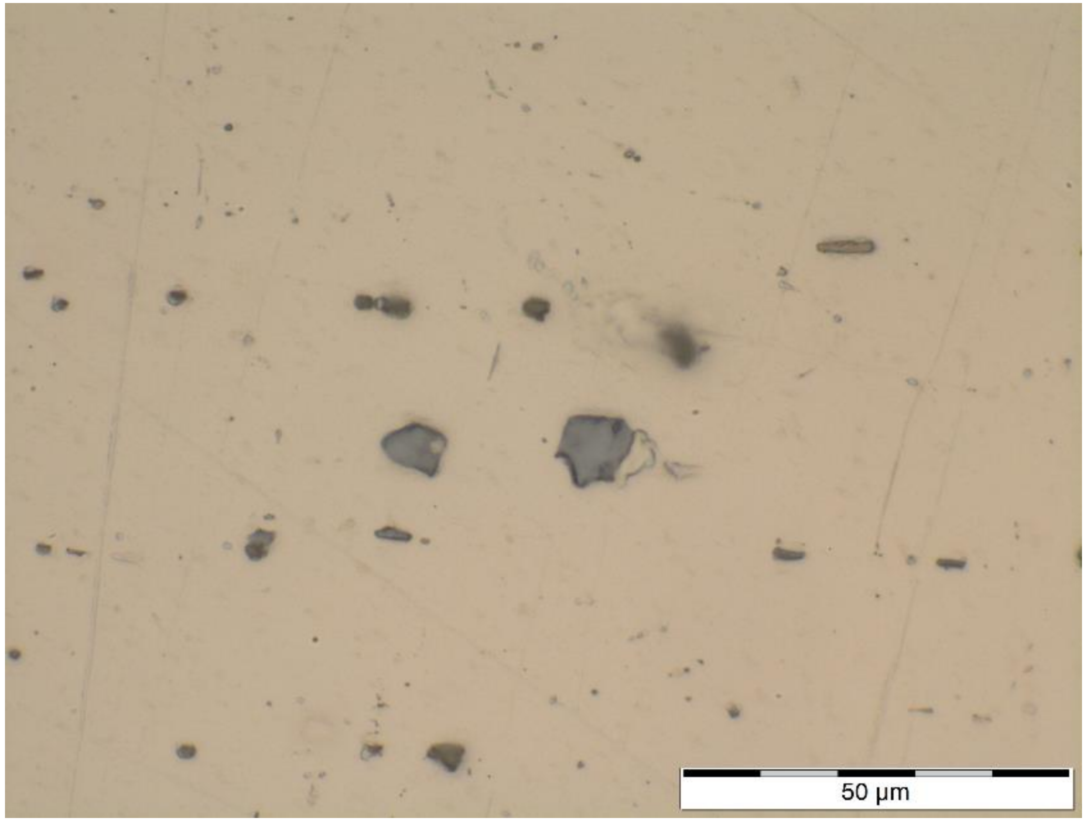
AJM016 Longitudinal





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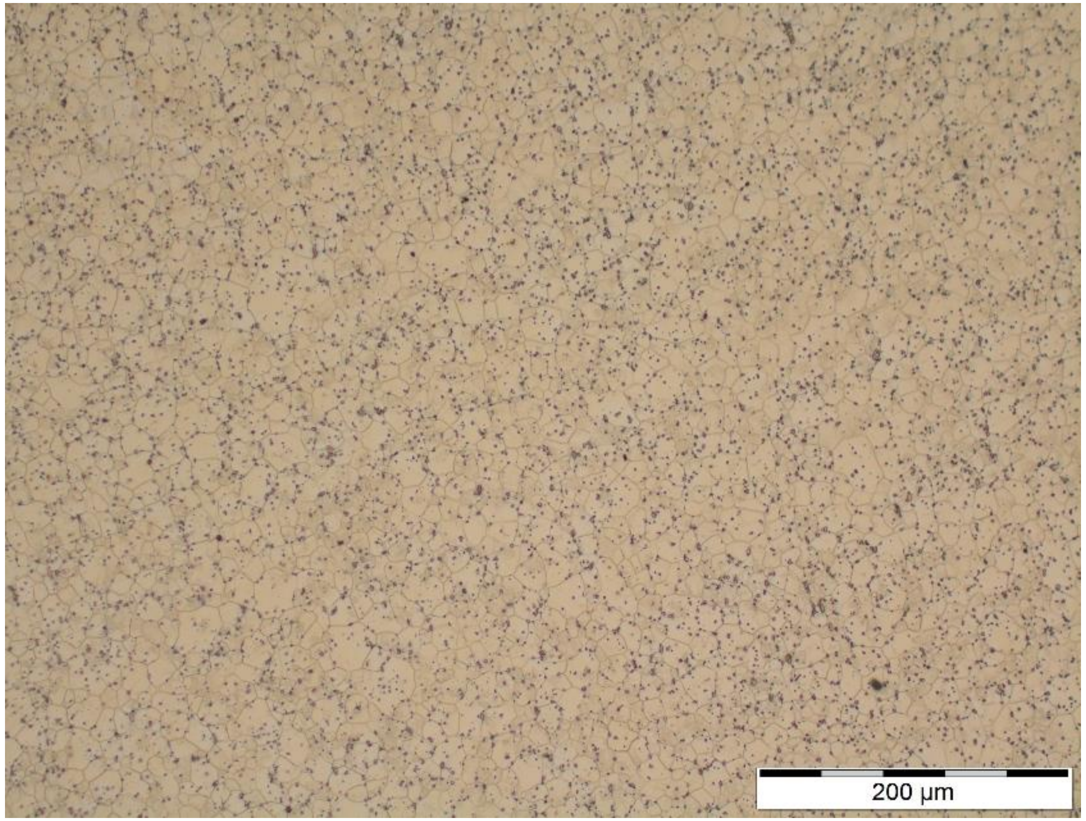
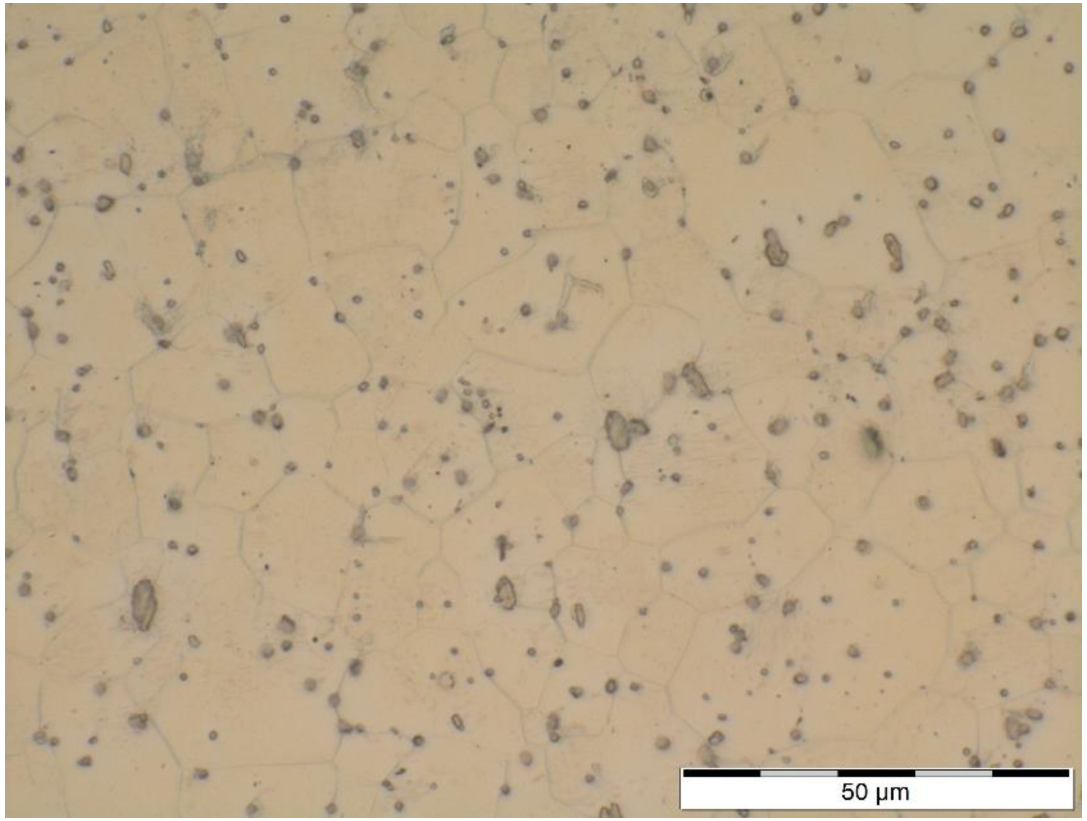
AJM017 Transverse





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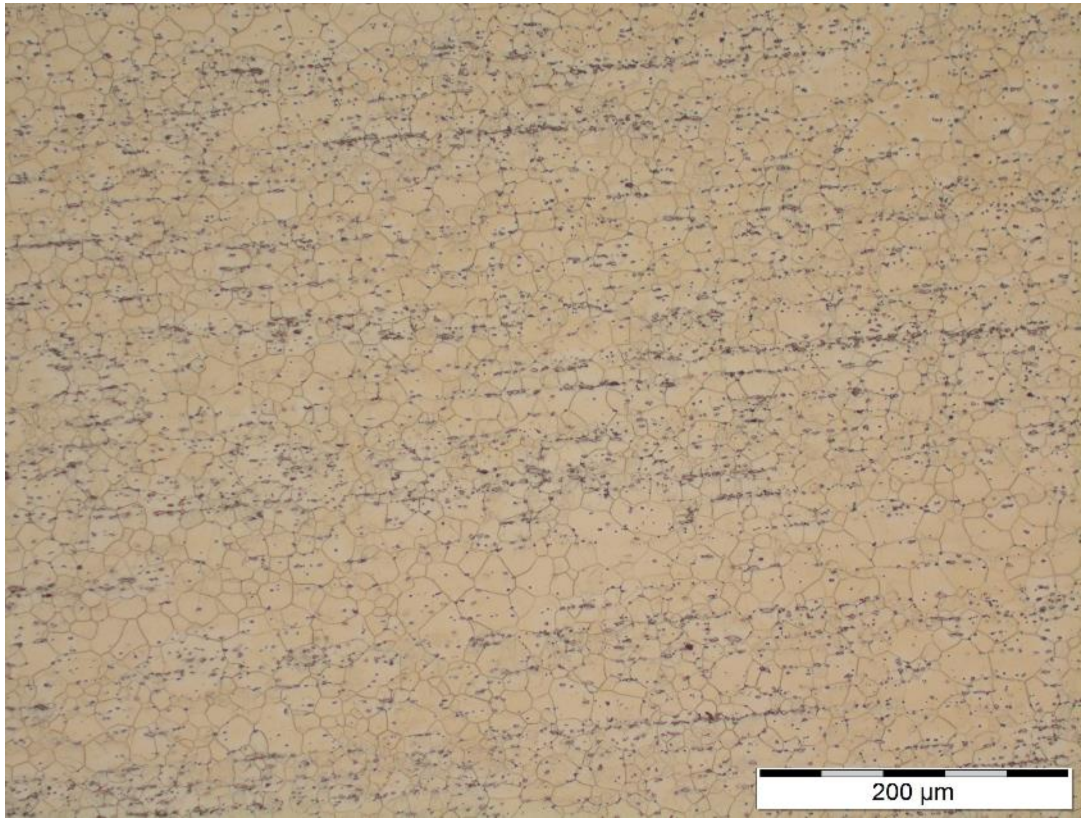
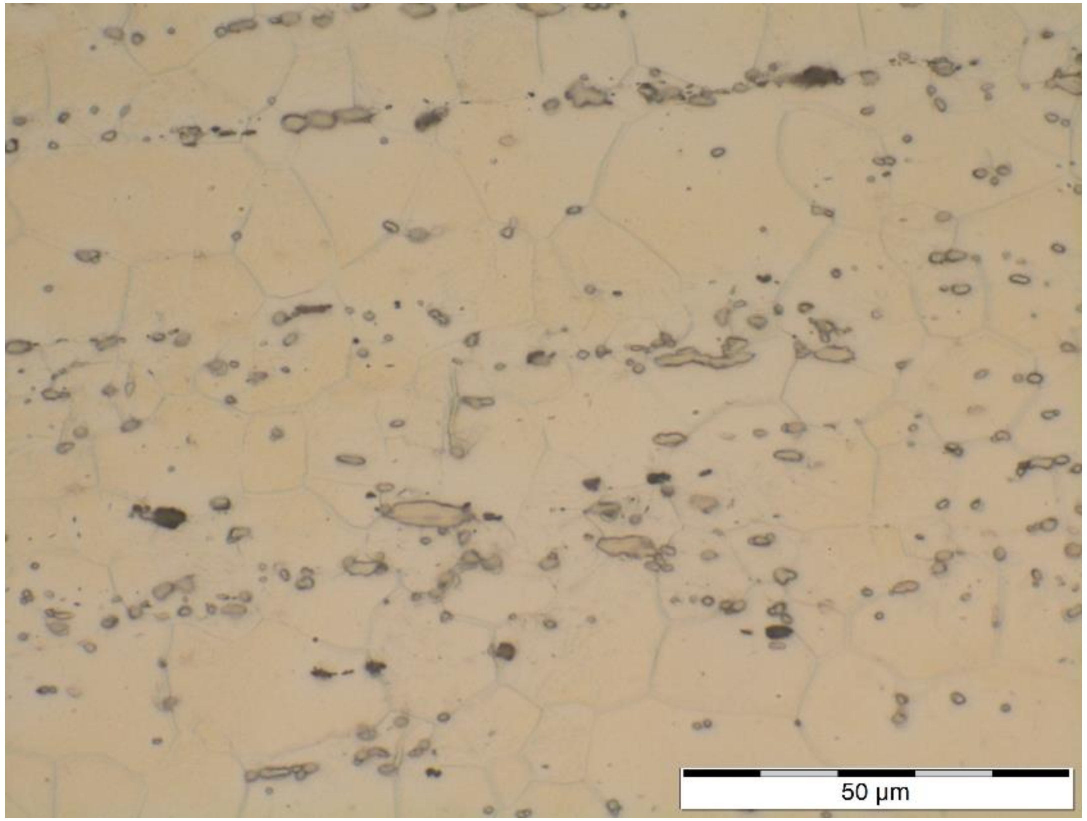
AJM017 Longitudinal





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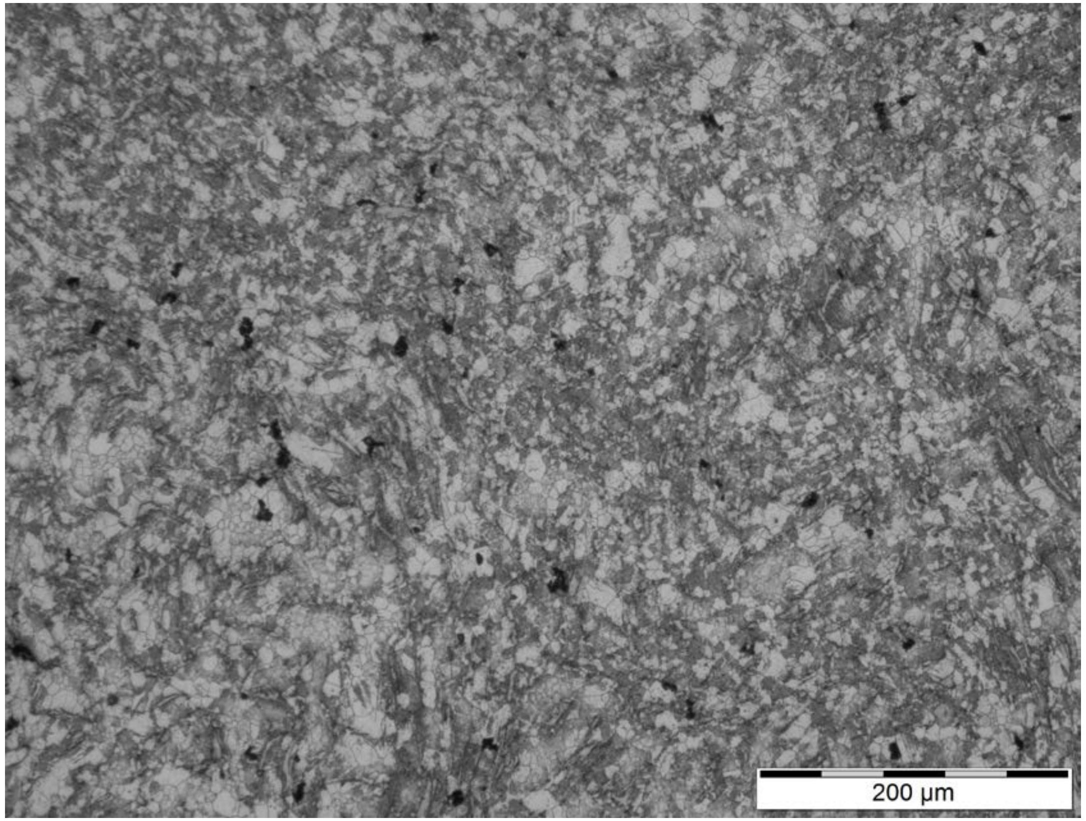
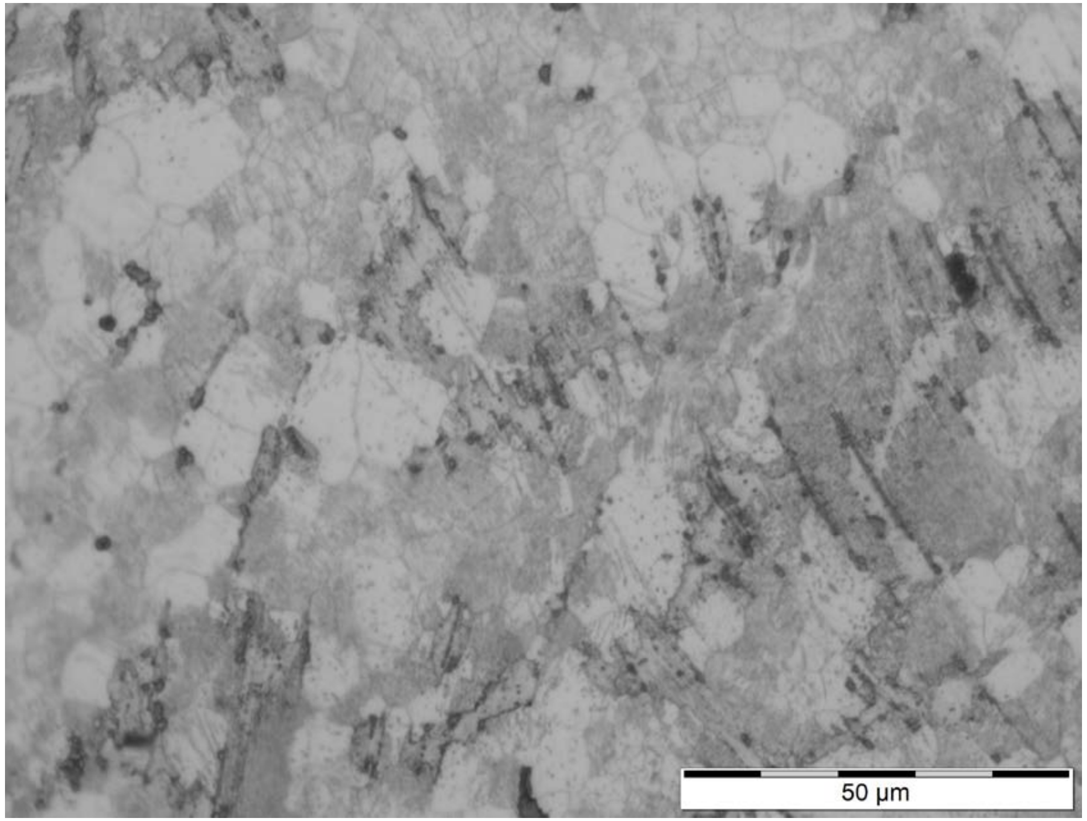
AJM018 Transverse





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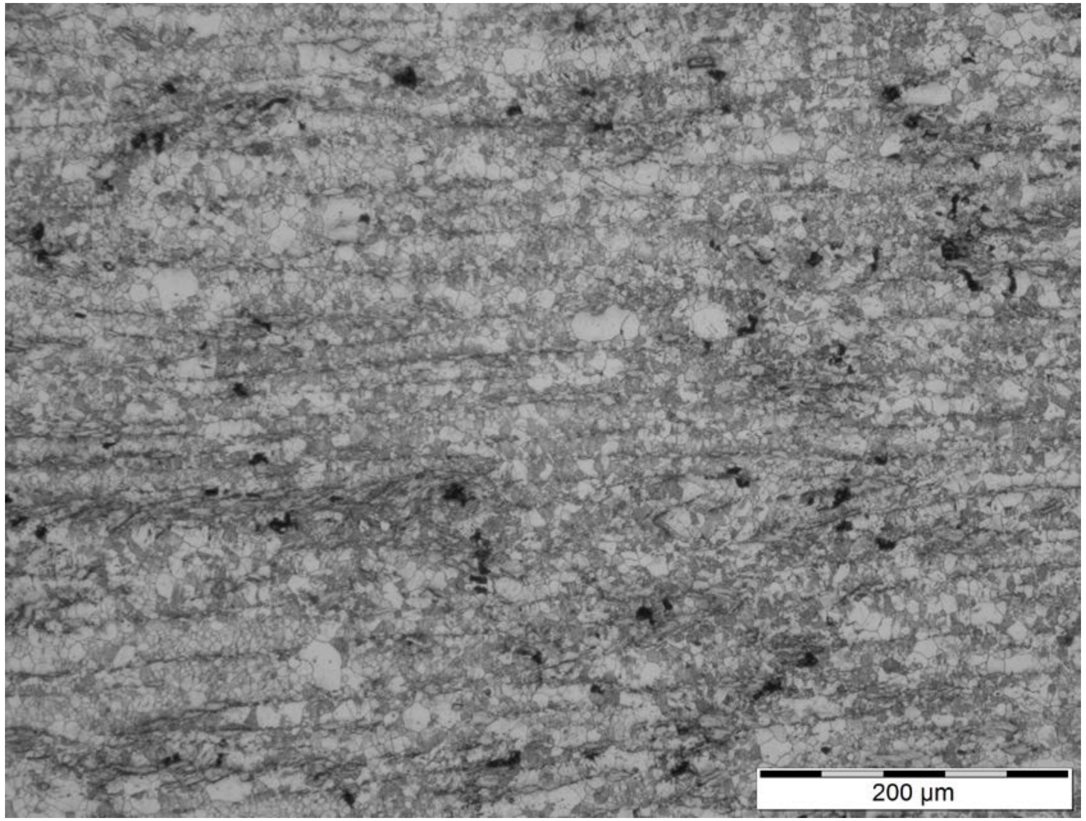
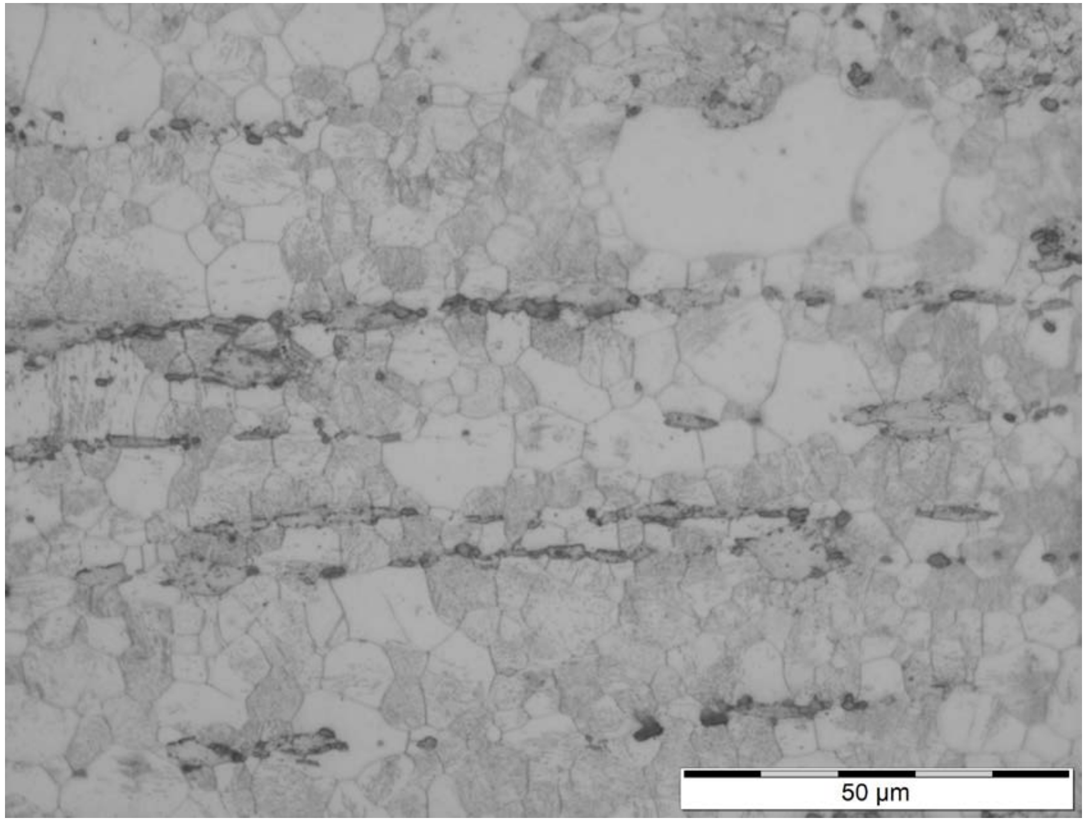
AJM018 Longitudinal





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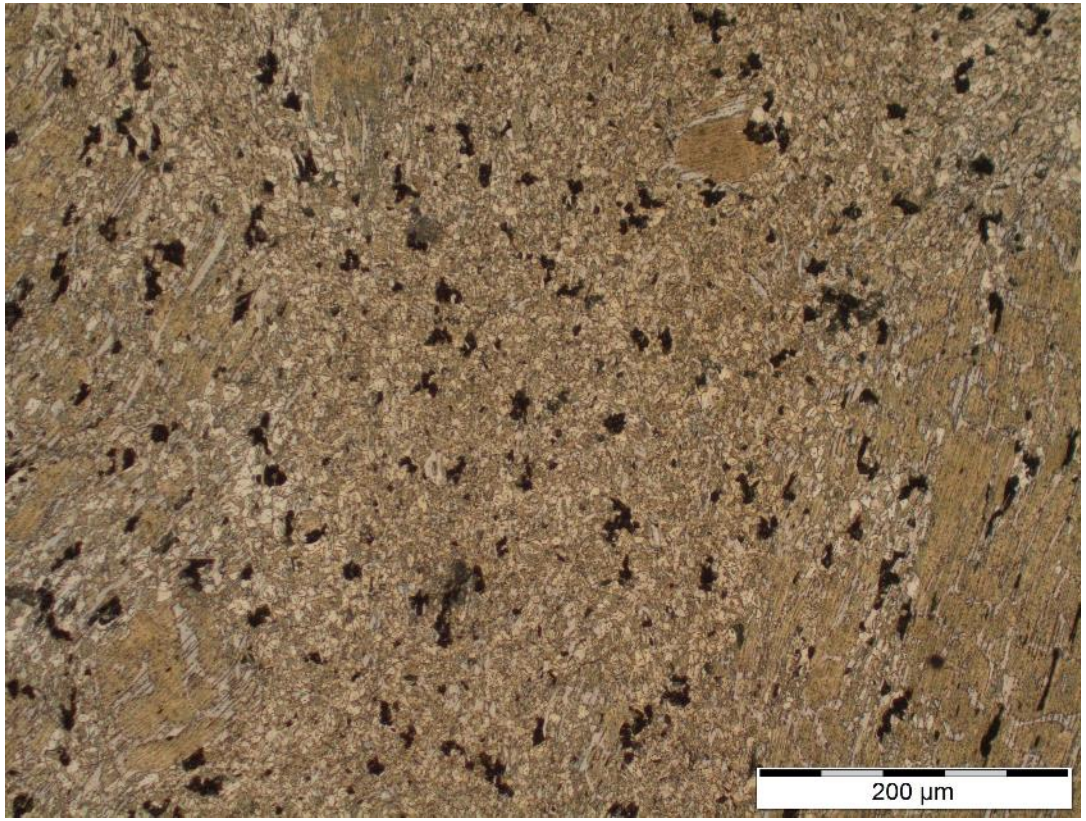
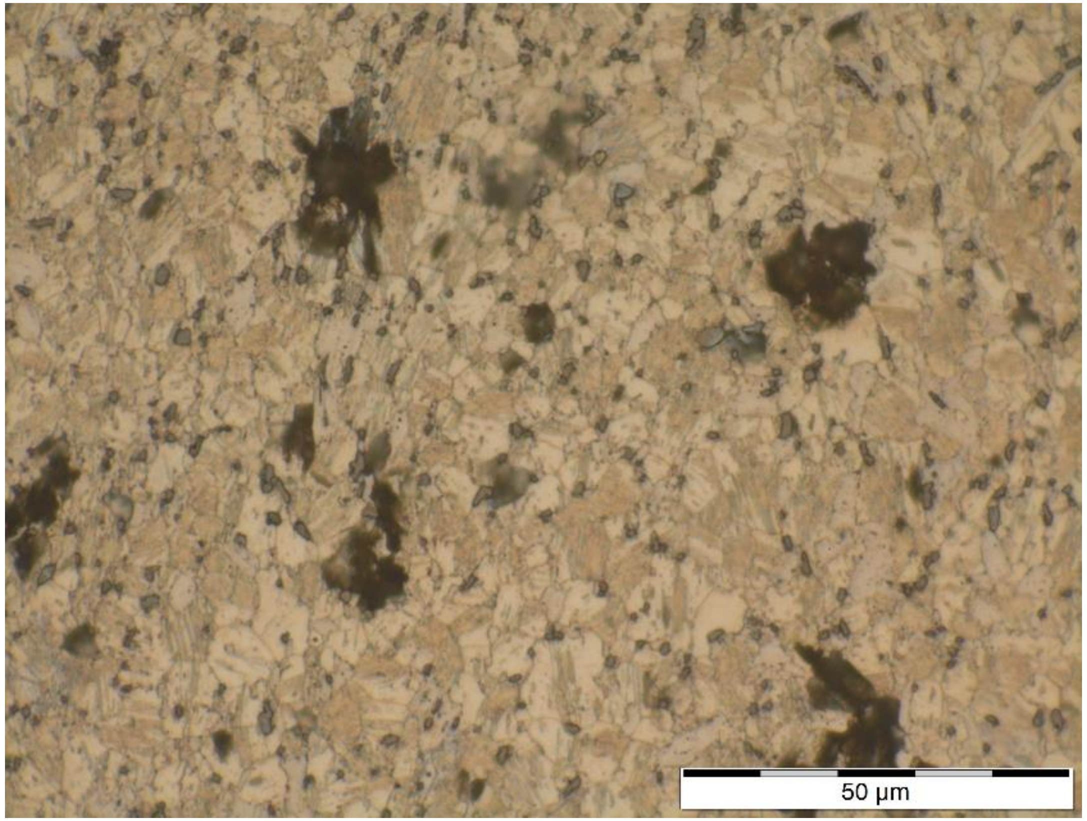
AJM023 Transverse





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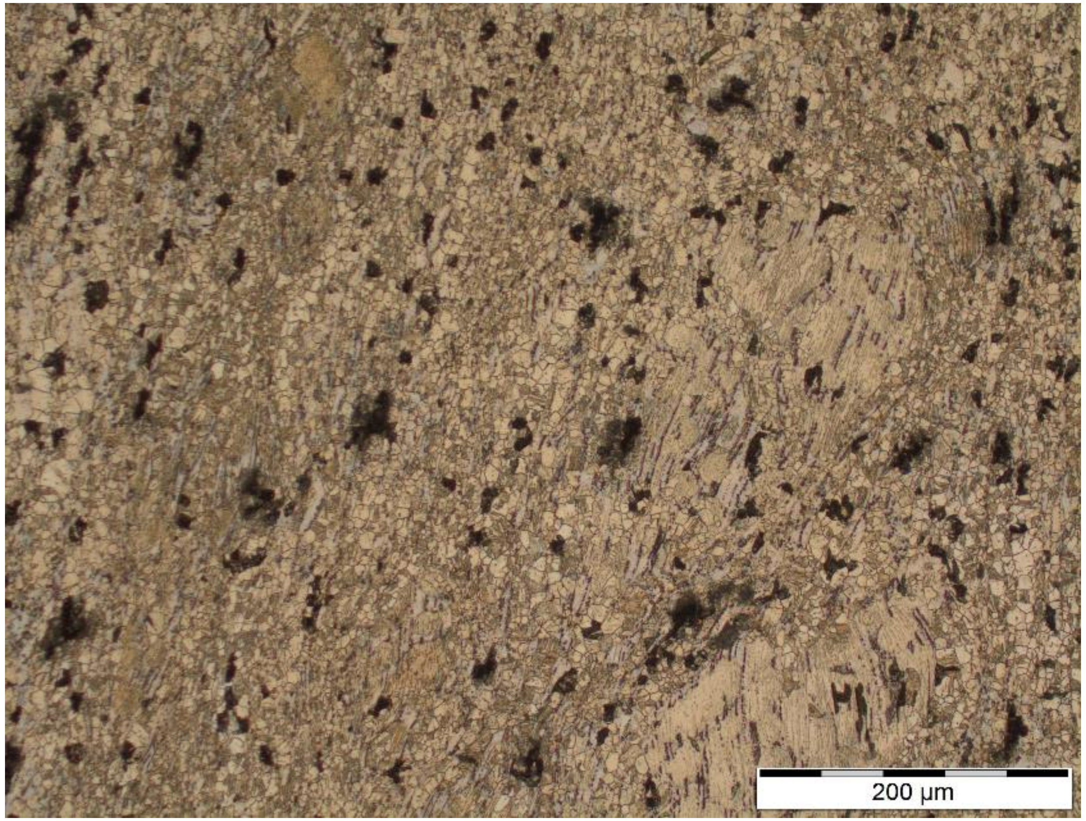
AJM023 Longitudinal



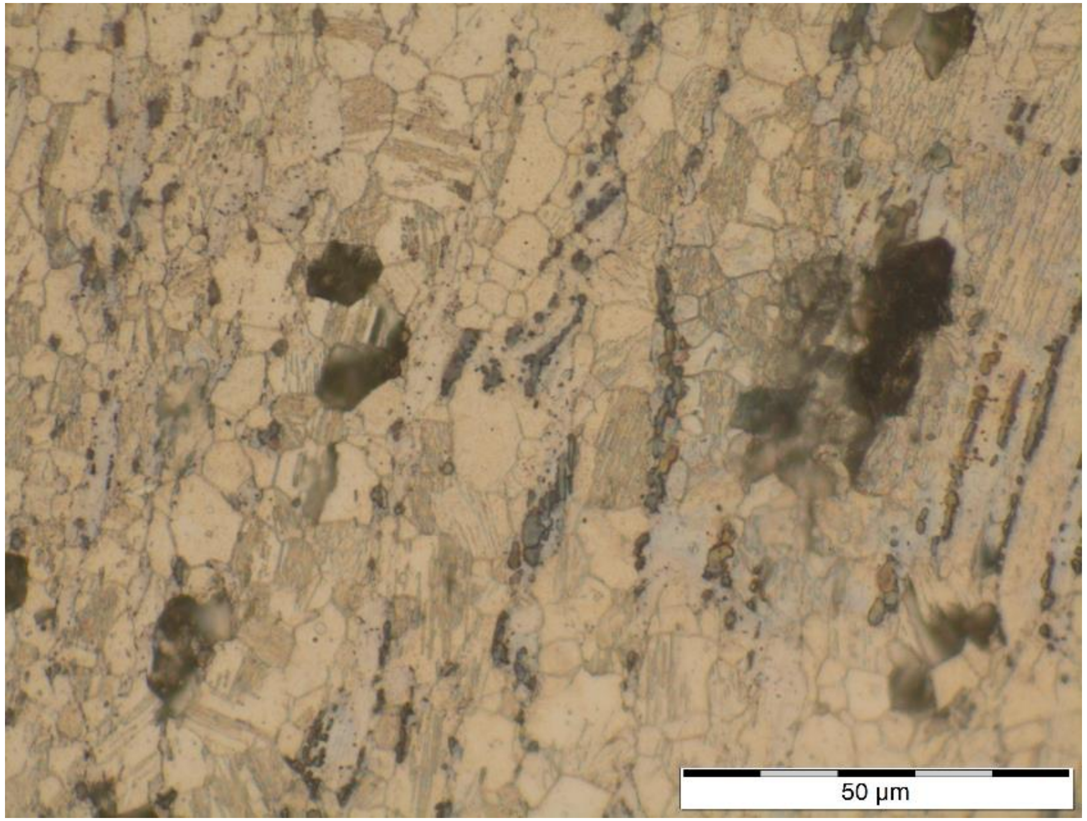


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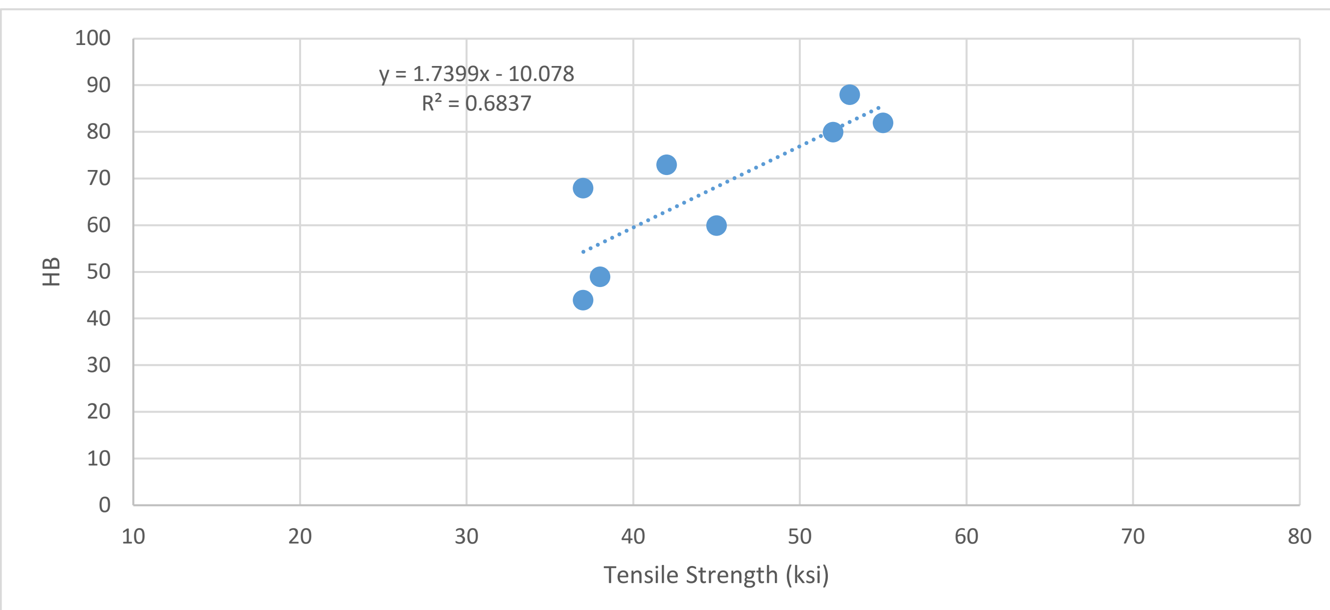
Exhibit E

Extruded Magnesium Hardness Evaluation (1907404.000 - 1531)

The tensile strength of received magnesium alloys was evaluated using microhardness hardness measurements on prepared metallurgical mounts. There is no known hardness measurement-tensile strength conversion chart established for magnesium alloys. Instead an empirical releationship was estabished using literature cited information between the tensile strength and Brinell hardness values. Based on these values a linear relationship was established.

Extruded bar and Shapes	Tensile (ksi) TS	Yield (ksi) YS	Hardness HB (500 kg 10 mm ball)
AZ31	38	29	49
AZ61A-F	45	33	60
AZ80A-T5	55	40	82
M1A-F	37	26	44
ZC71-F	52	49	80
ZK60A-T5	53	44	88
AZ31B-H24	42	32	73
HK31A-H24	37	29	68

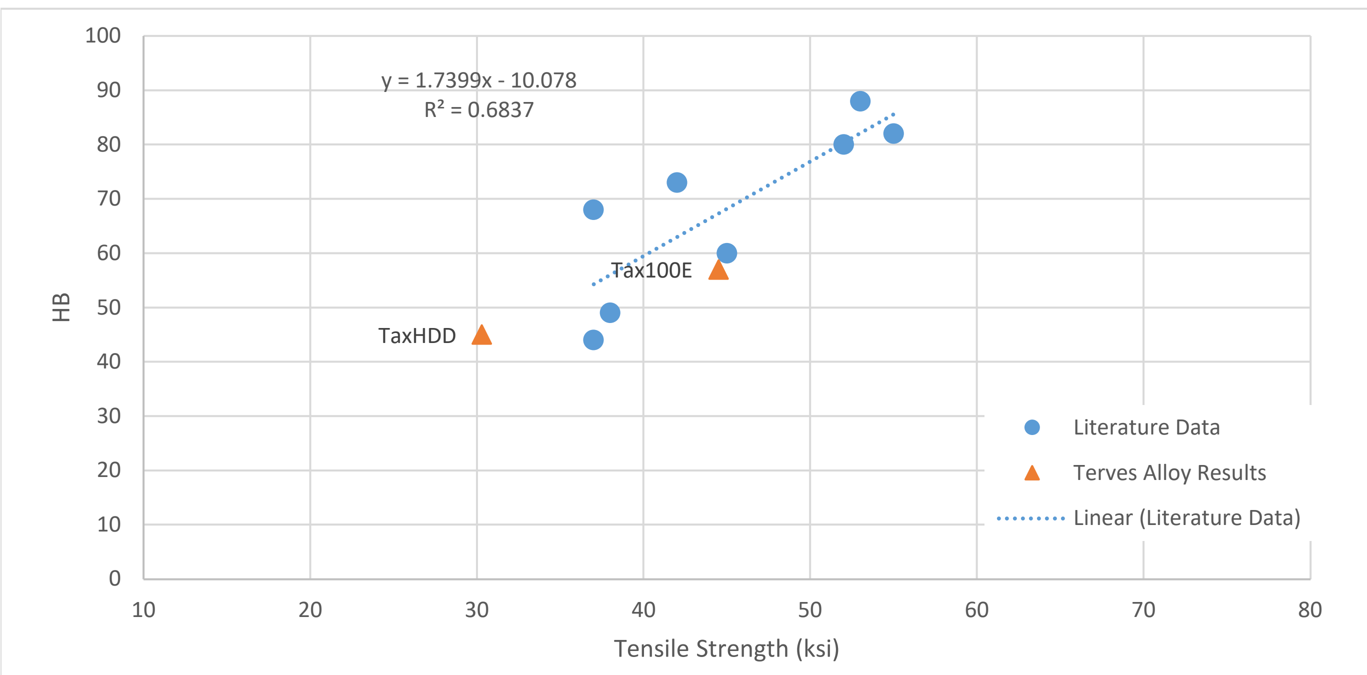
A best fit line using standard spreadsheet software (Excel) was determined to be:
y=1.7399x-10.078



Mechanical property data was available for two of the Terves alloys provided from mill certificates, but no mechanicla property data was available for any of the Ecometal materials recevied as part of this evaluation. The mechanical properties were estimated using hardness testing on metallugical mounts previously prepared for microstructural analysis. The samples were repolished. The microhardness (Vickers 500g) was measured at 5 locations for each of the Terves alloys. The microhardness data was converted from a Vickers hardness scale to the Brinell hardness scale (500kg 10 mm ball) using the table for Aluminum alloys in ASTM E140 or tables found in the ASM Metals Handbook Desk Edition.

Microhardness and Mechanical Property data for Tested Alloy Samples
Conversion used from Aluminum in E140

Terves composite		TS (ksi) from Mill Certificate	YS (ksi)	HV	HB (converted)
Tax100E		44.5	32	65	57
TaxHDD		30.3	20.2	51	45



The mechanical properties for the Ecometal alloys was not provided with the received samples so the mechanical properties were estimated using hardness measurements. For each received sample the Vickers microhardness was measured and converted to a Brinell hardness scale for comparison to the literature cited mechanical properties. The tensile strength was estimated using the best fit line through the literature cited values and calculating the tensile strength from the measured hardness value. The results are tabulated below and shown on the plot with literature cited values and Terves alloys.

Ecometal		Based on Curve Fit		Measured	Converted
Composite		Calculated TS (ksi)		HV	HB
AJM006		55		97	85
AJM010		29		44	40
AJM012		63		115	99
AJM016		33		54	48
AJM017		32		50	45
AJM018		36		58	52
AJM023		39		65	57

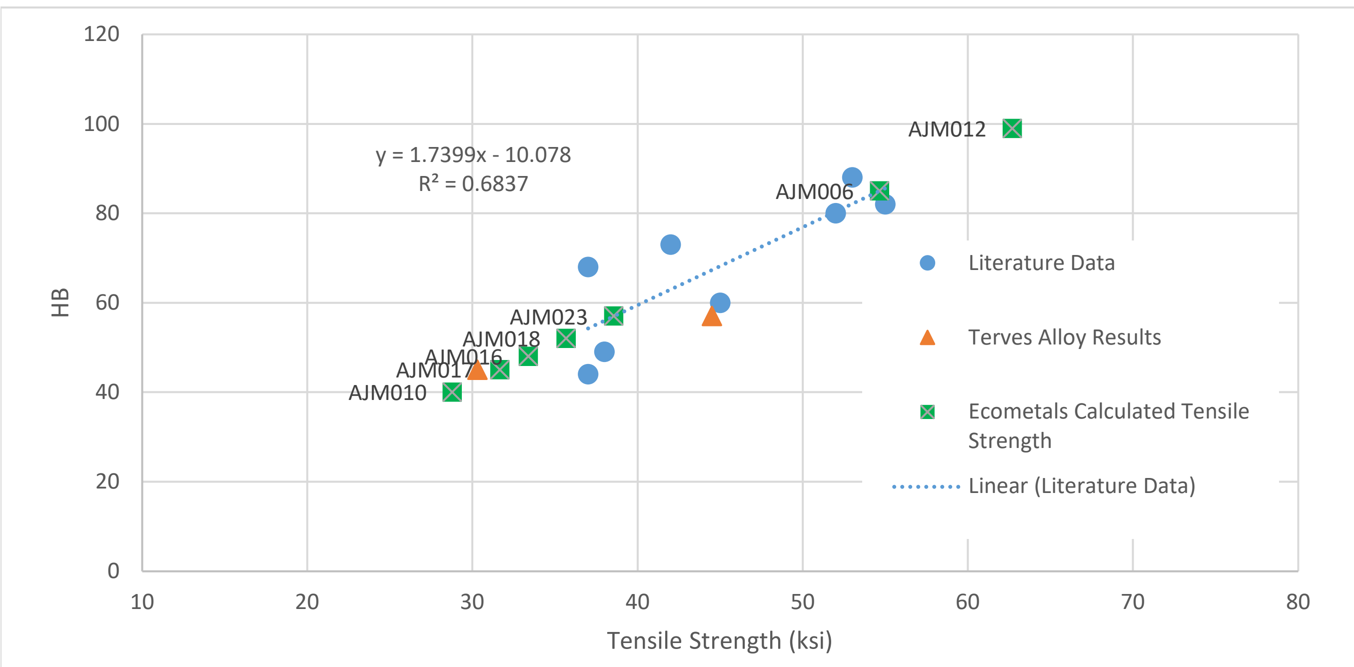


Exhibit F

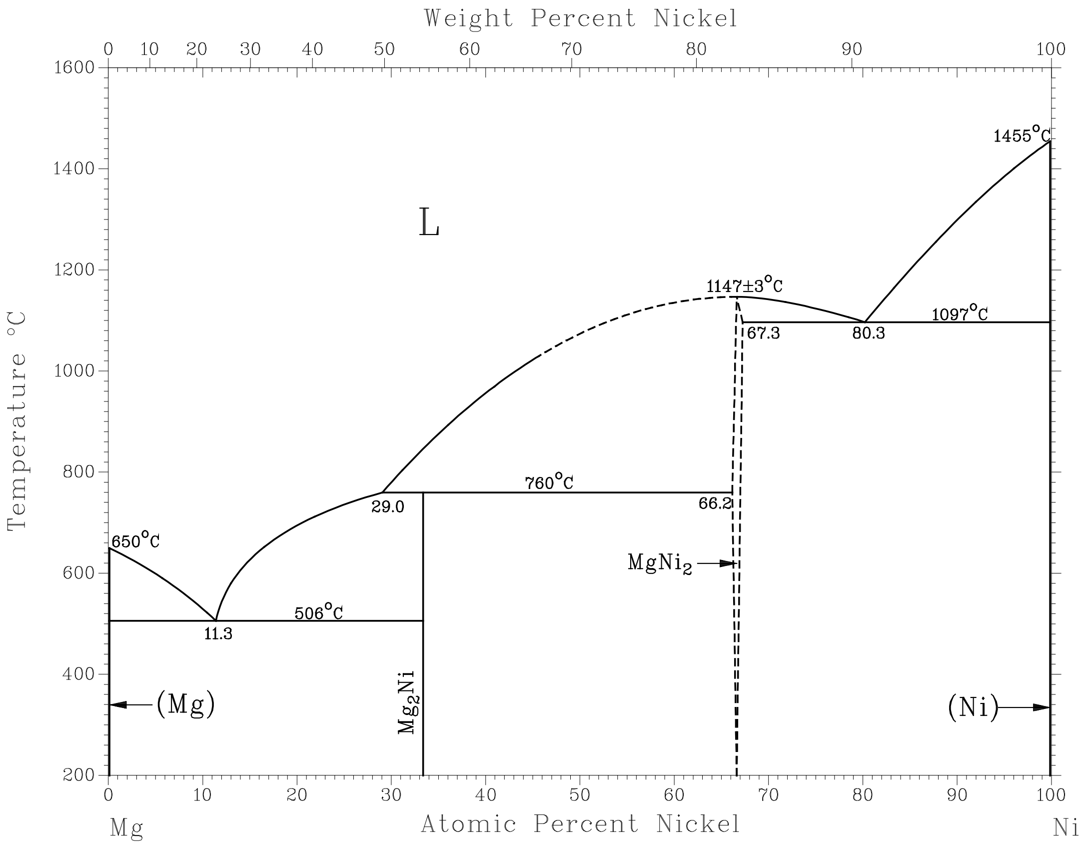


Exhibit F-1. Mg-Ni binary phase diagram. (ASM-International)

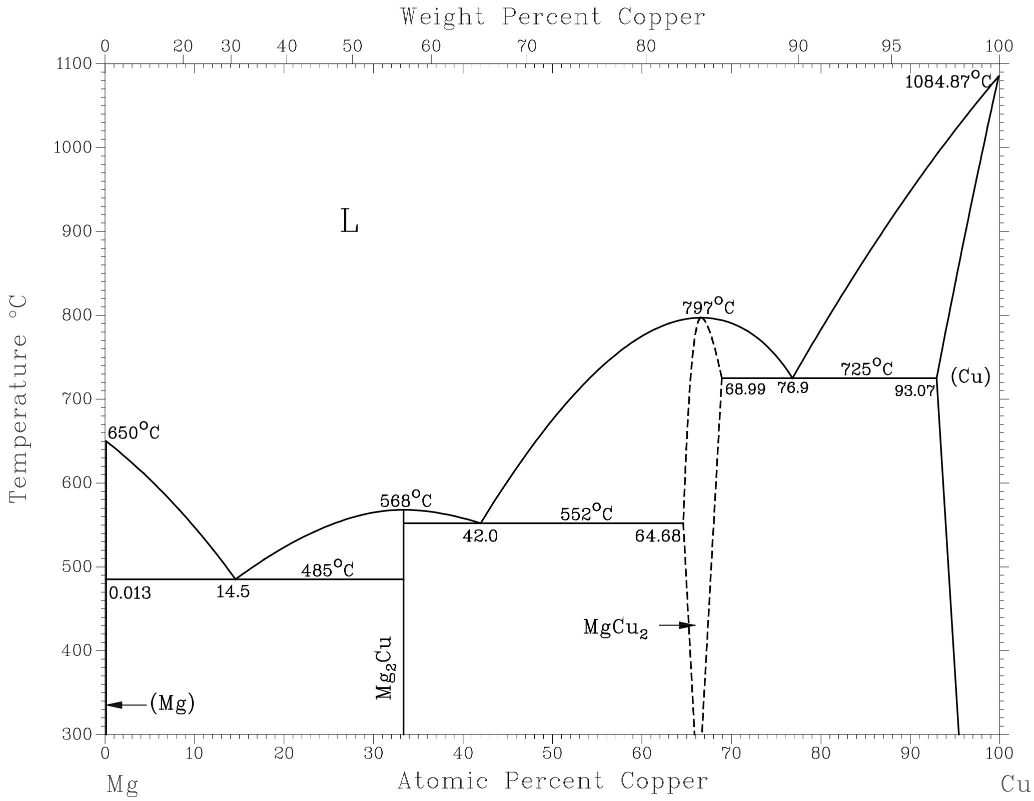


Exhibit F-2. Mg-Cu binary phase diagram. (ASM-International)

Exhibit G

The '653 Patent

	'653 Patent Claims	Infringement Conclusion
1	A magnesium composite	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are a magnesium composite.
	that includes in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 include in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite.
	said magnesium composite comprising a mixture of magnesium or a magnesium alloy and an additive material, said additive material having a greater melting point temperature than a solidus temperature of said magnesium, said additive material constituting about 0.05 wt. %-45 wt. % of said mixture, said additive material forming precipitant in said magnesium composite, said additive material includes one or more metals selected from the group consisting of copper, nickel, iron, and cobalt,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 comprise a mixture of magnesium or a magnesium alloy and an additive material, said additive material having the described aspects. AJM006, AJM012, AJM016, AJM017, and AJM018, contain at least copper constituting about 0.05 wt %-45 wt. %. AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 contain at least nickel constituting about 0.05 wt %-45 wt. %.
	said magnesium composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCI water mixture at 90° C.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCI water mixture at 90° C.

2	The magnesium composite as defined in Claim 1, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum, boron, bismuth, zinc, zirconium, and manganese.	All of the magnesium alloy of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023, includes over 50 wt. % magnesium and one or more metals selected from the group listed. AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 contain magnesium constituting over 50 wt. % and one or more metals consisting of aluminum, zinc, zirconium, and manganese.
3	The magnesium composite as defined in Claim 1, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in amount of about 0.1-3 wt. %, zirconium in an amount of about 0.01-1 wt. %, manganese in an amount of about 0.15-2 wt. %, boron in amount of about 0.0002-0.04 wt. %, and bismuth in amount of about 0.4-0.7 wt. %.	The magnesium alloy of AJM006, AJM012, AJM016, AJM018, and AJM023 includes over 50 wt. % magnesium and one or more metals selected from the group listed. AJM006, AJM012, AJM016, AJM018, and AJM023 include magnesium constituting over 50 wt. % and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in amount of about 0.1-3 wt. %, zirconium in an amount of about 0.01-1 wt. %, manganese in an amount of about 0.15-2 wt. %.
4	The magnesium composite as defined in Claim 1, wherein said additive material includes nickel, said nickel constitutes about 0.05-35 wt. % of said magnesium composite, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The additive material of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023, includes nickel, wherein said nickel constitutes about 0.05-35 wt. % of said magnesium composite and said nickel forms galvanically-active in situ precipitate in said magnesium composite.

5	The magnesium composite as defined in Claim 1, wherein said additive material includes copper, said copper constitutes about 0.05-35 wt. % of said magnesium composite, said copper forms galvanically-active in situ precipitate in said magnesium composite.	The additive material of AJM006, AJM012, AJM016, AJM017, and AJM018 includes copper, wherein said copper constitutes about 0.05-35 wt. % of said magnesium composite and said copper forms galvanically-active in situ precipitate in said magnesium composite. AJM006, AJM012, AJM016, AJM017, and AJM018 include copper constituting about 0.05-35 wt. % of said magnesium composite.
7	The magnesium composite as defined in Claim 1, where said magnesium composite is subjected to a deformation processing to reduce grain size of said magnesium composite, increase tensile yield strength of said magnesium composite, increase elongation of said magnesium composite, or combinations thereof.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are subjected to a deformation processing (extrusion) to reduce grain size of said magnesium composite, increase tensile yield strength of said magnesium composite, increase elongation of said magnesium composite, or combinations thereof.
9	The magnesium composite as defined in Claim 1, wherein a dissolution rate of said magnesium composite is about 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 have a dissolution rate of about 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
12	A magnesium composite	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are a magnesium composite.
	that includes in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 include in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite.

	comprising a mixture of a magnesium or a magnesium alloy and an additive material, said additive material having a greater melting point temperature than a solidus temperature of said magnesium, said composite including greater than 50 wt. % magnesium, said additive material constituting about 0.05-45 wt. % of said magnesium composite, said additive material having a melting point temperature that is 100° C. greater than a melting temperature of said magnesium or magnesium alloy, said additive material including one or more metals selected from the group consisting of copper, nickel, cobalt, titanium, and iron, at least a portion of said additive material remaining unalloyed additive material,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 comprise a mixture of a magnesium or a magnesium alloy and an additive material, said additive material (nickel) having a melting point temperature that is 100° C. greater than a melting temperature of said magnesium or magnesium alloy.
	said magnesium composite including in situ precipitation of galvanically-active intermetallic phases that includes said unalloyed additive material,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 include in situ precipitation of galvanically-active intermetallic phases that includes said unalloyed additive material.
	said magnesium composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
13	The magnesium composite as defined in Claim 12, wherein said additive material is added to said magnesium or magnesium alloy while said magnesium or magnesium alloy is at a temperature that is above said solidus temperature of said magnesium and a temperature that is less than a melting point of said additive material to form said mixture.	All of the additive material of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 is added to said magnesium or magnesium alloy while said magnesium or magnesium alloy is at a temperature that is above said solidus temperature of said magnesium and a temperature that is less than a melting point of said additive material to form said mixture.

14	The magnesium composite as defined in Claim 13, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in amount of about 0.1-3 wt. %, zirconium in an amount of about 0.01-1 wt. %, manganese in an amount of about 0.15-2 wt. %, boron in amount of about 0.0002-0.04 wt. %, and bismuth in an amount of about 0.4-0.7 wt. %.	The magnesium alloy of AJM006, AJM012, AJM016, AJM018, and AJM023 includes over 50 wt. % magnesium and one or more metals selected from the group listed. AJM006, AJM012, AJM016, AJM018, and AJM023 include magnesium alloy including over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in amount of about 0.1-3 wt. %, zirconium in an amount of about 0.01-1 wt. %, manganese in an amount of about 0.15-2 wt. %.
15	The magnesium composite as defined in Claim 14, wherein said additive material includes nickel, said nickel constitutes about 0.05-35 wt. % of said magnesium composite, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The additive material of AJM006, AJM010, AJM012, AJM016, AJM 017, AJM018, and AJM023 includes nickel, wherein said nickel constitutes about 0.05-35 wt. % of said magnesium composite and said nickel forms galvanically-active in situ precipitate in said magnesium composite.
18	The magnesium composite as defined in Claim 15, wherein a dissolution rate of said magnesium composite is at least 45 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. and up to 325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM018, and AJM023 have a dissolution rate between at least 45 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. and up to 325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.

19	The magnesium composite as defined in Claim 12, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in amount of about 0.1-6 wt. %, zirconium in an amount of about 0.01-3 wt. %, manganese in an amount of about 0.15-2 wt. %, boron in amount of about 0.0002-0.04 wt. %, and bismuth in an amount of about 0.4-0.7 wt. %.	AJM006, AJM012, AJM016, and AJM023 include magnesium alloy including over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in amount of about 0.1-6 wt. %, zirconium in an amount of about 0.01-3 wt. %, and manganese in an amount of about 0.15-2 wt. %.
20	The magnesium composite as defined in Claim 12, said additive material includes nickel, said nickel constitutes about 0.05-35 wt. % of said magnesium composite, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The additive of AJM006, AJM010, AJM012, AJM016, AJM 017, AJM018, and AJM023 includes nickel, wherein said nickel constitutes about 0.05-35 wt. % of said magnesium composite and said nickel forms galvanically-active in situ precipitate in said magnesium composite.
23	The magnesium composite as defined in Claim 12, wherein a dissolution rate of said magnesium composite is at least 45 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. and up to 325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM018 and AJM023 have a dissolution rate of said magnesium composite is at least 45 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. and up to 325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
25	A dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation,	AJM006, AJM012, AJM016, AJM018, and AJM023 are a dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation.
	said dissolvable magnesium alloy composite comprising at least 85 wt. % magnesium;	AJM006, AJM012, AJM016, AJM018, and AJM023 comprise at least 85 wt. % magnesium.

	one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese; and about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite,	AJM006, AJM012, AJM016, AJM018, and AJM023 comprise one or more metals selected from the group listed. AJM006, AJM012, AJM016, AJM018, and AJM023 include one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese; and about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite,
	said secondary metal including one or more metals selected from the group consisting of copper, nickel, cobalt, titanium and iron,	The secondary metal of AJM006, AJM012, AJM016, AJM018, and AJM023 includes one or more metals selected from the group listed. AJM006, AJM012, AJM016, AJM018, and AJM023 include one or more of copper, and nickel,
	said magnesium alloy composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCI water mixture at 90° C.	AJM006, AJM012, AJM016, AJM018, and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCI water mixture at 90° C.
26	The dissolvable magnesium alloy composite as defined in Claim 25, wherein a dissolution rate of said magnesium alloy composite is 100-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM023 has a dissolution rate between 100-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.

27	The dissolvable magnesium composite as defined in Claim 25, wherein said secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The secondary metal of AJM006, AJM012, AJM016, AJM018, and AJM023 includes nickel, wherein said nickel forms galvanically-active in situ precipitate in said magnesium composite. AJM006, AJM012, AJM016, AJM018, and AJM023 include nickel as a secondary metal.
29	A dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation,	AJM018 and AJM023 are a dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation.
	said dissolvable magnesium alloy composite comprising 60-95 wt. % magnesium;	AJM018 and AJM023 comprise 60-95 wt. % magnesium.
	0.01-1 wt. % zirconium; and	AJM018 and AJM023 include 0.01-1 wt. % zirconium,
	about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper, nickel, cobalt, titanium and iron,	AJM018 and AJM023 include about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper and nickel,
	said magnesium alloy composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM018 and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
30	The dissolvable magnesium alloy composite as defined in Claim 29, wherein a dissolution rate of said magnesium alloy composite is 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM018 and AJM023 have a dissolution rate between 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.

31	The dissolvable magnesium composite as defined in Claim 29, wherein said secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The secondary metal of AJM018 and AJM023 includes nickel, wherein said nickel forms galvanically-active in situ precipitate in said magnesium composite. AJM018 and AJM023 include nickel as a secondary metal.
33	A dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation,	AJM006 is a dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation.
	said dissolvable magnesium alloy composite comprising 60-95 wt. % magnesium;	AJM006 comprises 60-95 wt. % magnesium.
	0.5-10 wt. % aluminum;	AJM006 includes 0.5-10 wt. % aluminum
	0.05-6 wt. % zinc;	AJM006 includes 0.05-6 wt. % zinc
	0.15-2 wt. % manganese; and	AJM006 includes 0.15-2 wt. % manganese
	about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper, nickel, cobalt, titanium and iron,	AJM006 includes about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper, and nickel.
	said magnesium alloy composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006 has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.

34	The dissolvable magnesium alloy composite as defined in Claim 33, wherein a dissolution rate of said magnesium alloy composite is 5-325 mg/cm'/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006 has a dissolution rate of said magnesium alloy composite is 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
35	The dissolvable magnesium composite as defined in Claim 33, wherein said secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The secondary metal of AJM006 includes nickel, wherein said nickel forms galvanically-active in situ precipitate in said magnesium composite. AJM006 includes a secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.
37	A dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation,	AJM023 is a dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation.
	said dissolvable magnesium alloy composite comprising 60-95 wt. % magnesium;	AJM023 comprises 60-95 wt. % magnesium.
	0.05-6 wt. % zinc;	AJM023 includes 0.05-6 wt. % zinc
	0.01-1 wt. % zirconium; and	AJM023 includes 0.01-1 wt. % zirconium
	about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper, nickel, cobalt, titanium and iron,	AJM023 has about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper and nickel
	said magnesium alloy composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM023 has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.

38	The dissolvable magnesium alloy composite as defined in Claim 37, wherein a dissolution rate of said magnesium alloy composite is 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM023 has a dissolution rate of 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. AJM023 has a dissolution rate between 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
39	The dissolvable magnesium composite as defined in Claim 37, wherein said secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The secondary metal of AJM023 includes nickel, wherein said nickel forms galvanically-active in situ precipitate in said magnesium composite. AJM023 includes nickel as a secondary metal.
41	A dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation,	AJM006, AJM012, AJM016, AJM018, and AJM023 are a dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation.
	said dissolvable magnesium alloy composite comprising over 50 wt. % magnesium;	AJM006, AJM012, AJM016, AJM018, and AJM023 comprise over 50 wt. % magnesium.
	one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese; and	AJM006, AJM012, AJM016, AJM018, and AJM023 comprise one or more metals selected from the group listed. AJM006, AJM012, AJM016, AJM018, and AJM023 include one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese

	about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper, nickel and cobalt,	AJM006, AJM012, AJM016, AJM018, and AJM023 comprise about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group listed. AJM006, AJM012, AJM016, AJM018, and AJM023 include one or more metals selected from the group consisting of copper and nickel
	said magnesium alloy composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM012, AJM016, AJM018, and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
42	The dissolvable magnesium alloy composite as defined in Claim 41, wherein a dissolution rate of said magnesium alloy composite is 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM012, AJM016, AJM018, and AJM023 have a dissolution rate of 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. AJM006, AJM012, AJM016, AJM018, and AJM023 have a dissolution rate between 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
43	The dissolvable magnesium composite as defined in Claim 41, wherein said secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The secondary metal of AJM006, AJM012, AJM016, AJM018, and AJM023 includes nickel, wherein said nickel forms galvanically-active in situ precipitate in said magnesium composite. AJM006, AJM012, AJM016, AJM018, and AJM023 include nickel.

45	A dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation,	AJM006, AJM012, AJM016, AJM018, and AJM023 are a dissolvable magnesium alloy composite for use in a ball or other tool component in a well drilling or completion operation.
	said dissolvable magnesium alloy composite comprising over 50 wt. % magnesium;	AJM006, AJM012, AJM016, AJM018, and AJM023 comprise over 50 wt. % magnesium.
	one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.01-1 wt. % zirconium, 0.05-1 wt. % manganese, 0.0002-0.04 wt. % boron, and 0.4-0.7 wt. % bismuth; and	AJM006, AJM012, AJM016, AJM018, and AJM023 include metals selected from the group consisting of 0.1-3 wt. % zinc, 0.01-1 wt. % zirconium, 0.05-1 wt. % manganese,
	about 0.05-45 wt. % of a secondary metal to form a galvanically-active intermetallic particle that promotes corrosion of said dissolvable magnesium alloy composite, said secondary metal including one or more metals selected from the group consisting of copper, nickel, and cobalt,	AJM006, AJM012, AJM016, AJM018, and AJM023 include about 0.05-45 wt. % of a secondary metal, including one or more of copper and nickel.
	said magnesium alloy composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM012, AJM016, AJM018, and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C
46	The dissolvable magnesium alloy composite as defined in Claim 45, wherein a dissolution rate of said magnesium alloy composite is 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM012, AJM016, AJM018, and AJM023 have a dissolution rate of said magnesium alloy composite is 5-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
47	The dissolvable magnesium composite as defined in Claim 45, wherein said secondary metal includes nickel, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	AJM006, AJM012, AJM016, AJM018, and AJM023 include nickel.

49	A magnesium composite	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are a magnesium composite.
	that includes in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 include in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite.
	said magnesium composite comprising a mixture of magnesium or a magnesium alloy and an additive material, said additive material constituting about 0.05-45 wt. % of said mixture, said additive material includes one or more metals selected from the group consisting of copper, nickel, titanium, iron, and cobalt,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 comprise a mixture of magnesium or a magnesium alloy and an additive material, said additive material (nickel, or nickel and copper) having the described aspects.
	said magnesium composite including in situ precipitation of galvanically-active intermetallic phases that include said additive material, said additive material located in sufficient quantities in said galvanically-active intermetallic phases so as to obtain a composition and morphology of said galvanically-active intermetallic phases such that a galvanic corrosion rate along said galvanically-active intermetallic phases causes said magnesium composite to have a dissolution rate of at least at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 include in situ precipitation of galvanically-active intermetallic phases that include said additive material, said additive material having the described aspects.
50	The magnesium composite as defined in Claim 49, wherein said additive material includes one or more metals selected from the group consisting of copper, nickel, and cobalt.	The additive material of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 includes one or more metals selected from the group consisting of copper and nickel.

52	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes over 50 wt. % magnesium, and one or more metals selected from the group consisting of aluminum, boron, bismuth, zinc, zirconium, and manganese.	The magnesium alloy of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 includes over 50 wt. % magnesium, and one or more metals selected from the group listed.
53	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes over 50 wt. % magnesium, and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in an amount of about 0.1-6 wt. %, zirconium in an amount of about 0.01-3 wt. %, manganese in an amount of about 0.15-2 wt. %, boron in an amount of about 0.0002-0.04 wt. %, and bismuth in amount of about 0.4-0.7 wt. %.	AJM006, AJM012, AJM016, AJM018, and AJM023 includes over 50 wt. % magnesium, and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in an amount of about 0.1-6 wt. %, zirconium in an amount of about 0.01-3 wt. %, and manganese in an amount of about 0.15-2 wt. %
54	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes over 50 wt. % magnesium, and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in an amount of about 0.1-3 wt. %, zirconium in an amount of about 0.01-1 wt. %, manganese in an amount of about 0.15-2 wt. %, boron in an amount of about 0.0002-0.04 wt. %, and bismuth in an amount of about 0.4-0.7 wt. %.	AJM006, AJM012, AJM018, and AJM023 include over 50 wt. % magnesium, and one or more metals selected from the group consisting of aluminum in an amount of about 0.5-10 wt. %, zinc in an amount of about 0.1-3 wt. %, zirconium in an amount of about 0.01-1 wt. %, and manganese in an amount of about 0.15-2 wt. %.
55	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes at least 85 wt. % magnesium, and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM006, AJM012, AJM016, AJM018, and AJM023 include at least 85 wt. % magnesium, and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.

56	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes 60-95 wt. % magnesium and 0.01-1 wt. % zirconium.	AJM018 and AJM023 include 60-95 wt. % magnesium and 0.01-1 wt. % zirconium.
57	The magnesium composite as defined in Claim 56, wherein said magnesium alloy further includes 0.05-6 wt. % zinc.	AJM023 further includes 0.05-6 wt. % zinc.
58	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes 60-95 wt. % magnesium, 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, and 0.15-2 wt. % manganese.	AJM006 includes 60-95 wt. % magnesium, 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, and 0.15-2 wt. % manganese.
59	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM006, AJM012, AJM016, AJM018, and AJM023 include one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese.
60	The magnesium composite as defined in Claim 49, wherein said magnesium alloy includes over 50 wt. % magnesium, and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.01-1 wt. % zirconium, 0.05-1 wt. % manganese, 0.0002-0.04 wt. % boron, and 0.4-0.7 wt. % bismuth.	AJM006, AJM012, AJM016, and AJM023 include over 50 wt. % magnesium, and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.01-1 wt. % zirconium, and 0.05-1 wt. % manganese,
61	The magnesium composite as defined in Claim 49, wherein said additive material includes nickel, said nickel constitutes about 0.05-35 wt. % of said magnesium composite, said nickel forms galvanically-active in situ precipitate in said magnesium composite.	The additive material of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 nickel, wherein said nickel constitutes about 0.05-35 wt. % of said magnesium composite and said nickel forms galvanically-active in situ precipitate in said magnesium composite.

64	The magnesium composite as defined in Claim 49, wherein said additive material includes copper, said copper constitutes about 0.05-35 wt. % of said magnesium composite, said copper forms the galvanically-active in situ precipitate in said magnesium composite.	AJM006, AJM012, AJM016, AJM017, and AJM18 include copper constituting about 0.05-35 wt. %.
66	The magnesium composite as defined in Claim 49, wherein a dissolution rate of said magnesium composite is about 5-325 mg/cm**2/hr. in 3 wt. % KCI water mixture at 90° C.	AJM006, AJM010, AJM012, AJM016, AJM 017, AJM018, and AJM023 have a dissolution rate of about 5-325 mg/cm**2/hr. in 3 wt. % KCI water mixture at 90° C.
67	The magnesium composite as defined in Claim 49, wherein a dissolution rate of said magnesium composite is at least 45 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. and up to 325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM018 and AJM023 have a dissolution rate of at least 45 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C. and up to 325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
69	The magnesium composite as defined in Claim 49, wherein said additive material has a melting point temperature that is 100° C. greater than a melting temperature of said magnesium or magnesium alloy.	The additive material of AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 has a melting point temperature that is 100° C. greater than a melting temperature of said magnesium or magnesium alloy.
70	The magnesium composite as defined in Claim 49, wherein said magnesium composite is at least partially included in a down hole well component, said down hole well component including one or more components selected from the group consisting of a sleeve, frac ball, hydraulic actuating tooling, tube, valve, valve component, or plug.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are at least partially included in a down hole well component, said down hole well component including one or more components selected from the group listed.
74	A dissolvable magnesium composite for use in a ball or other tool component in a well drilling or completion operation,	AJM018 and AJM023 are a dissolvable magnesium composite for use in a ball or other tool component in a well drilling or completion operation.

	said dissolvable magnesium composite includes in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite,	AJM018 and AJM023 include in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite.
	said magnesium composite comprising a mixture of magnesium or a magnesium alloy and an additive material, said additive material constituting at least 0.1 wt. % of said mixture, said magnesium in said magnesium composite constituting at least 85 wt. %, said additive material is a metal material selected from the group consisting of copper, nickel and cobalt,	AJM018 and AJM023 include an additive material constituting at least 0.1 wt. % of said mixture, said magnesium in said magnesium composite constituting at least 85 wt. %, said additive material is a metal material selected from the group consisting of copper and nickel
	said magnesium composite including in situ precipitation of galvanically-active intermetallic phases that include said additive material,	AJM018 and AJM023 include in situ precipitation of galvanically-active intermetallic phases that include said additive material,
	said magnesium composite has a dissolution rate of 84-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.	AJM018 and AJM023 have a dissolution rate of 84-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90° C.
76	The magnesium composite as defined in Claim 74, wherein said additive material includes nickel, a content of said nickel in said magnesium composite is at least 0.3 wt. %.	AJM018 and AJM023 include nickel, a content of said nickel in said magnesium composite is at least 0.3 wt. %.

Exhibit H

The '740 Patent

	'740 Patent Claims	Infringement Conclusion
2	A dissolvable magnesium composite	AJM018 and AJM023 are dissolvable magnesium composites
	that at least partially forms a ball, a frac ball, a tube, a plug or other tool component that is to be used in a well drilling or completion operation,	AJM018 and AJM023 form a ball, a frac ball, a tube, a plug, and other tool components that are used in a well drilling or completion operation
	said dissolvable dissolvable [sic] magnesium composite includes in situ precipitate,	AJM018 and AJM023 have in situ precipitate
	said dissolvable magnesium composite comprising a mixture of magnesium or a magnesium alloy and an additive material,	AJM018 and AJM023 comprise a mixture of magnesium or magnesium alloy and an additive material
	said magnesium composite includes greater than 50 wt. % magnesium,	AJM018 and AJM023 comprise greater than 50 wt. % magnesium
	said in situ precipitate includes said additive material,	AJM018 and AJM023 have in situ precipitate that includes additive material
	said additive material includes one or more metal materials selected from the group consisting of a) copper wherein said copper constitutes 0.1-35 wt. % of said dissolvable magnesium composite, b) wt. % nickel wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium composite, and c) cobalt wherein said cobalt constitutes 0.1-20 wt. % of said dissolvable magnesium composite,	AJM018 has a wt. % nickel in the range of .1-35 wt. % of said dissolvable magnesium composite and a wt. % copper in the range of .1-23.5 wt. % of said dissolvable magnesium composite and AJM023 has a wt. % nickel in the range of .1-35 wt. % of said dissolvable magnesium composite
	said dissolvable magnesium composite has a dissolution rate of at least 75 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 and AJM023 have a dissolution rate of 75-325 mg/cm.sup.2/hr. in 3 wt. % KCl water mixture at 90.degree. C.

3	The dissolvable magnesium composite as defined in Claim 2, wherein said dissolvable magnesium composite has a dissolution rate of 75-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 and AJM023 satisfy Claim 2 and have a dissolution rate of 75-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
4	The dissolvable magnesium composite as defined in Claim 2, wherein said dissolvable magnesium composite has a dissolution rate of 84-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 and AJM023 satisfy Claim 2 and have a dissolution rate of at least 84-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
5	The dissolvable magnesium composite as defined in Claim 2, wherein said dissolvable magnesium composite has a dissolution rate of 100-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM023 satisfies Claim 2 and has a dissolution rate of 100-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
8	The dissolvable magnesium composite as defined in Claim 2, wherein said magnesium alloy comprises greater than 50 wt. % magnesium and no more than 10 wt. % aluminum, and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM018 and AJM023 satisfy Claim 2 and are composed of greater than 50 wt. % magnesium and no more than 10 wt. % aluminum, and one or more metals selected from the group consisting of 0.1-2 wt. % zinc, and 0.01-1 wt. % zirconium.
9	The dissolvable magnesium composite as defined in Claim 2, wherein said magnesium alloy comprises greater than 50 wt. % magnesium and no more than 10 wt. % aluminum, and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.05-1 wt. % zirconium, 0.05-0.25 wt. % manganese, 0.0002-0.04 wt. % boron, and 0.4-0.7 wt. % bismuth.	AJM018 and AJM023 satisfy Claim 2 and are composed of greater than 50 wt. % magnesium and no more than 10 wt. % aluminum, and contains 0.1-3 wt. % zinc.
10	The dissolvable magnesium composite as defined in Claim 2, wherein said additive material includes nickel.	AJM018 and AJM023 satisfy Claim 2 and contain nickel as an additive material.

11	The dissolvable magnesium composite as defined in Claim 2, wherein said additive material includes nickel, said nickel constitutes 0.3-7 wt. % of said dissolvable magnesium composite.	AJM018 and AJM023 satisfy Claim 2 and contain nickel as an additive material constituting between 0.3-7 wt. %.
13	The dissolvable magnesium composite as defined in Claim 2, wherein said additive material includes copper.	AJM018 satisfies Claim 2 and includes copper.
16	The dissolvable magnesium composite as defined in Claim 2, wherein said magnesium content in said dissolvable magnesium composite is at least 75 wt. %.	AJM018 and AJM023 satisfy Claim 2 and include magnesium constituting at least 75 wt. %.
17	The dissolvable magnesium composite as defined in Claim 2, wherein said magnesium content in said dissolvable magnesium composite is at least 85 wt. %.	AJM018 and AJM023 satisfy Claim 2 and include magnesium constituting at least 85 wt. %.
19	A dissolvable magnesium cast composite	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are dissolvable magnesium cast composites
	comprising a mixture of magnesium or a magnesium alloy	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 comprise a mixture of magnesium alloy

	and an additive material, said additive material includes one or more metals selected from the group consisting of a) copper wherein said copper constitutes at least 0.01 wt. % of said dissolvable magnesium cast composite, b) nickel wherein said nickel constitutes at least 0.01 wt. % of said dissolvable magnesium cast composite, and c) cobalt wherein said cobalt constitutes at least 0.01 wt. % of said dissolvable magnesium cast composite,	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 are a mixture magnesium alloy and one or more additive materials consisting of at least 0.01 wt. % copper, and at least 0.01 wt. % nickel AJM006 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % copper and 0.01 wt. % nickel AJM010 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % nickel AJM012 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % copper and 0.01 wt. % nickel AJM016 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % copper and 0.01 wt. % nickel AJM017 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % copper and 0.01 wt. % nickel AJM018 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % copper and 0.01 wt. % nickel AJM023 is a mixture magnesium alloy and additive material consisting of at least 0.01 wt. % copper and 0.01 wt. % nickel

	said magnesium composite includes in situ precipitate, said in situ precipitate includes said additive material,	AJM006, AJM010, AJM 012, AJM016, AJM017, AJM018, and AJM023 have in situ precipitate, and the in situ precipitate includes said additive materials
	a plurality of particles of said in situ precipitate having a size of no more than 50 .mu.m,	AJM006, AJM010, AJM 012, AJM016, AJM017, AJM018, and AJM023 have a plurality of particles of in situ precipitate of a size no more than 50 µm
	said magnesium composite has a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM006, AJM010, AJM 012, AJM016, AJM017, AJM018, and AJM023 have a dissolution rate of at least 5 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
20	The dissolvable magnesium cast composite as defined in Claim 19, wherein said magnesium composite includes at least 85 wt. % magnesium.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 19 and all include at least 85 wt. % magnesium.
21	The dissolvable magnesium cast composite as defined in Claim 19, wherein said magnesium composite has a dissolution rate of at least 40 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 19 and have a dissolution rate of at least 40 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
22	The dissolvable magnesium cast composite as defined in Claim 20, wherein said magnesium composite has a dissolution rate of at least 40 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 20 and have a dissolution rate of at least 40 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
23	The dissolvable magnesium cast composite as defined in Claim 19, wherein said magnesium composite includes no more than 10 wt. % aluminum.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 19 and all include no more than 10 wt. % aluminum.

24	The dissolvable magnesium cast composite as defined in Claim 20, wherein said magnesium composite includes no more than 10 wt. % aluminum.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 20 and all include no more than 10 wt. % aluminum.
25	The dissolvable magnesium cast composite as defined in Claim 21, wherein said magnesium composite includes no more than 10 wt. % aluminum.	AJM018, and AJM023 satisfy Claim 21 and include no more than 10 wt.% aluminum.
26	The dissolvable magnesium cast composite as defined in Claim 22, wherein said magnesium composite includes no more than 10 wt. % aluminum.	AJM018, and AJM023 satisfy Claim 21 and include no more than 10 wt.% aluminum.
27	The dissolvable magnesium cast composite as defined in Claim 23, wherein said magnesium composite includes at least 50 wt. % magnesium.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 23 and all include at least 50 wt. % magnesium.
28	The dissolvable magnesium cast composite as defined in Claim 25, wherein said magnesium composite includes at least 50 wt. % magnesium.	AJM018, and AJM023 satisfy Claim 25 and at least 50 wt. % magnesium.
29	The dissolvable magnesium cast composite as defined in Claim 19, wherein said dissolvable magnesium cast composite has a dissolution rate of 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 19 and have a dissolution rate between 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
30	The dissolvable magnesium cast composite as defined in Claim 20, wherein said dissolvable magnesium cast composite has a dissolution rate of 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 20 and have a dissolution rate between 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.

31	The dissolvable magnesium cast composite as defined in Claim 22, wherein said dissolvable magnesium cast composite has a dissolution rate of 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 22 and have a dissolution rate between 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
32	The dissolvable magnesium cast composite as defined in Claim 23, wherein said dissolvable magnesium cast composite has a dissolution rate of 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 23 and have a dissolution rate between 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
33	The dissolvable magnesium cast composite as defined in Claim 27, wherein said dissolvable magnesium cast composite has a dissolution rate of 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018, and AJM023 satisfy Claim 27 and have a dissolution rate between 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree C.
34	The dissolvable magnesium cast composite as defined in Claim 28, wherein said dissolvable magnesium cast composite has a dissolution rate of 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 and AJM023 satisfy Claim 28 and have a dissolution rate between 40-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
35	The dissolvable magnesium cast composite as defined in Claim 27, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum, boron, bismuth, zinc, zirconium, and manganese.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 27 and all have a magnesium alloy which includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum, zinc, zirconium, and manganese.
36	The dissolvable magnesium cast composite as defined in Claim 28, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum, boron, bismuth, zinc, zirconium, and manganese.	AJM018 and AJM023 satisfy Claim 28, and include magnesium constituting over 50 wt. % and one or more metals selected from the group consisting of aluminum, zinc, zirconium, and manganese.

37	The dissolvable magnesium cast composite as defined in Claim 27, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-6 wt. %, zirconium in an amount of 0.01-3 wt. %, manganese in an amount of 0.15-2 wt. %, boron in an amount of 0.0002-0.04 wt. %, and bismuth in an amount of 0.4-0.7 wt. %.	AJM006, AJM012, AJM016, AJM018 and AJM023 satisfy Claim 27, and include magnesium constituting over 50 wt. % and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-6 wt. %, zirconium in an amount of 0.01-3 wt. %, manganese in an amount of 0.15-2 wt. %.
38	The dissolvable magnesium cast composite as defined in Claim 28, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-6 wt. %, zirconium in an amount of 0.01-3 wt. %, manganese in an amount of 0.15-2 wt. %, boron in an amount of 0.0002-0.04 wt. %, and bismuth in an amount of 0.4-0.7 wt. %.	AJM018 and AJM023 satisfy Claim 28, and include magnesium constituting over 50 wt. % and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-6 wt. %, zirconium in an amount of 0.01-3 wt. %, manganese in an amount of 0.15-2 wt. %.
39	The dissolvable magnesium cast composite as defined in Claim 27, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-3 wt. %, zirconium in an amount of 0.01-1 wt. %, manganese in an amount of 0.15-2 wt. %, boron in an amount of 0.0002-0.04 wt. %, and bismuth in amount of 0.4-0.7 wt. %.	AJM006, AJM012, AJM016, AJM018, and AJM023 satisfy Claim 27, and include magnesium constituting over 50 wt. % and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-3 wt. %, zirconium in an amount of 0.01-1 wt. %, manganese in an amount of 0.15-2 wt. %.

40	The dissolvable magnesium cast composite as defined in Claim 28, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of aluminum in an amount of 0.5-10 wt. %, zinc in an amount of 0.1-3 wt. %, zirconium in an amount of 0.01-1 wt. %, manganese in an amount of 0.15-2 wt. %, boron in an amount of 0.0002-0.04 wt. %, and bismuth in amount of 0.4-0.7 wt. %.	AJM018 and AJM023 satisfy Claim 28, and include magnesium constituting over 50 wt. % and one or more metals selected from the group consisting of zinc in an amount of 0.1-3 wt. % and zirconium in an amount of 0.01-1 wt. %.
41	The dissolvable magnesium cast composite as defined in Claim 20, wherein said magnesium alloy includes at least 85 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM006, AJM 012, AJM016, AJM018, and AJM023 satisfy Claim 20, and include at least 85 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.
42	The dissolvable magnesium cast composite as defined in Claim 22, wherein said magnesium alloy includes at least 85 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM018, and AJM023 satisfy Claim 22, and include magnesium constituting at least 85 wt. % and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium.
43	The dissolvable magnesium cast composite as defined in Claim 23, wherein said magnesium alloy includes at least 85 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM006, AJM 012, AJM016, AJM018, and AJM023 satisfy Claim 23, and include magnesium constituting at least 85 wt. % and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.05-6 wt. % zinc, 0.01-3 wt. % zirconium, and 0.15-2 wt. % manganese.

44	The dissolvable magnesium cast composite as defined in Claim 27, wherein said magnesium alloy comprises greater than 50 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM006, AJM012, AJM016, AJM018, and AJM023 satisfy Claim 27, and include magnesium constituting greater than 50 wt. % and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese.
45	The dissolvable magnesium cast composite as defined in Claim 28, wherein said magnesium alloy comprises greater than 50 wt. % magnesium and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium, and 0.15-2 wt. % manganese.	AJM018 and AJM023 satisfy Claim 28, and include magnesium constituting greater than 50 wt. % and one or more metals selected from the group consisting of 0.5-10 wt. % aluminum, 0.1-2 wt. % zinc, 0.01-1 wt. % zirconium.
46	The dissolvable magnesium cast composite as defined in Claim 27, wherein said magnesium alloy comprises greater than 50 wt. % magnesium and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.05-1 wt. % zirconium, 0.05-0.25 wt. % manganese, 0.0002-0.04 wt. % boron, and 0.4-0.7 wt. % bismuth.	AJM006, AJM012, AJM016, AJM018, and AJM023 satisfy Claim 27, and include magnesium constituting greater than 50 wt. % and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.05-1 wt. % zirconium, 0.05-0.25 wt. % manganese.
47	The dissolvable magnesium cast composite as defined in Claim 28, wherein said magnesium alloy comprises greater than 50 wt. % magnesium and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.05-1 wt. % zirconium, 0.05-0.25 wt. % manganese, 0.0002-0.04 wt. % boron, and 0.4-0.7 wt. % bismuth.	AJM018 and AJM023 satisfy Claim 28, and include magnesium constituting greater than 50 wt. % and one or more metals selected from the group consisting of 0.1-3 wt. % zinc and 0.05-1 wt. % zirconium.

51	The dissolvable magnesium cast composite as defined in Claim 19, wherein said magnesium alloy includes over 50 wt. % magnesium and one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.01-1 wt. % zirconium, 0.05-1 wt. % manganese, 0.0002-0.04 wt. % boron, and 0.4-0.7 wt. % bismuth.	AJM006, AJM012, AJM016, AJM018, and AJM023 satisfy Claim 19, and include one or more metals selected from the group consisting of 0.1-3 wt. % zinc, 0.01-1 wt. % zirconium, 0.05-1 wt. % manganese.
52	The dissolvable magnesium cast composite as defined in Claim 19, wherein said additive material includes nickel, said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 19 and all contain nickel, wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.
53	The dissolvable magnesium cast composite as defined in Claim 20, wherein said additive material includes nickel, said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 20 and all contain nickel, wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.
54	The dissolvable magnesium cast composite as defined in Claim 22, wherein said additive material includes nickel, said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM018 and AJM023 satisfy Claim 22, and include nickel constituting between 0.1-23.5 wt. %.
55	The dissolvable magnesium cast composite as defined in Claim 23, wherein said additive material includes nickel, said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 23 and all contain nickel, wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.

56	The dissolvable magnesium cast composite as defined in Claim 27, wherein said additive material includes nickel, said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 27 and include nickel constituting between 0.1-23.5 wt. %.
57	The dissolvable magnesium cast composite as defined in Claim 28, wherein said wherein said additive material includes nickel, said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM018 and AJM023 satisfy Claim 28 and include nickel constituting between 0.1-23.5 wt. %.
58	The dissolvable magnesium cast composite as defined in Claim 19, wherein said additive material includes copper, said copper constitutes 0.01-35 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM012, AJM016, AJM017, and AJM018 satisfy Claim 19 and include copper constituting between 0.01-35 wt. %.
59	The dissolvable magnesium cast composite as defined in Claim 20, wherein said additive material includes copper, said copper constitutes 0.01-35 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM012, AJM016, AJM017, and AJM018 satisfy Claim 20, and include copper constituting between 0.01-35 wt. %.
60	The dissolvable magnesium cast composite as defined in Claim 22, wherein said additive material includes copper, said copper constitutes 0.01-35 wt. % of said dissolvable magnesium cast composite.	AJM018 satisfies Claim 22, and include copper constituting 0.01-35 wt.
61	The dissolvable magnesium cast composite as defined in Claim 23, wherein said additive material includes copper, said copper constitutes 0.01-35 wt. % of said dissolvable magnesium cast composite.	AJM006, AJM012, AJM016, AJM017, and AJM018 satisfies Claim 23, and include copper constituting 0.01-35 wt. %.

62	The dissolvable magnesium cast composite as defined in Claim 17, wherein said additive material includes copper, said copper constitutes 0.01-35 wt. % of said dissolvable magnesium cast composite.	AJM018 satisfies Claim 17, and include copper constituting 0.01-35 wt. %.
63	The dissolvable magnesium cast composite as defined in Claim 28, wherein said additive material includes copper, said copper constitutes 0.01-35 wt. % of said dissolvable magnesium cast composite.	AJM018 satisfies Claim 28, and include copper constituting 0.01-35 wt. %.
64	The dissolvable magnesium cast composite as defined in Claim 19, wherein said additive material includes copper, said copper constitutes 0.5-15 wt. % of said dissolvable magnesium cast composite.	AJM012, AJM017, and AJM018 satisfy Claim 19, and include copper constituting 0.5-15 wt. %.
65	The dissolvable magnesium cast composite as defined in Claim 20, wherein said additive material includes copper, said copper constitutes 0.5-15 wt. % of said dissolvable magnesium cast composite.	AJM012, AJM017, and AJM018 satisfy Claim 20, and include copper constituting at least 0.5-15 wt. % of AJM012, AJM017, and AJM018.
66	The dissolvable magnesium cast composite as defined in Claim 22, wherein said additive material includes copper, said copper constitutes 0.5-15 wt. % of said dissolvable magnesium cast composite.	AJM018 satisfies Claim 22, and include copper constituting 0.5-15 wt. % of AJM018.
67	The dissolvable magnesium cast composite as defined in Claim 23, wherein said additive material includes copper, said copper constitutes 0.5-15 wt. % of said dissolvable magnesium cast composite.	AJM012, AJM017, and AJM018 satisfy Claim 23, and include copper constituting between 0.5-15 wt. % of AJM012, AJM017, and AJM018.

68	The dissolvable magnesium cast composite as defined in Claim 27, wherein said additive material includes copper, said copper constitutes 0.5-15 wt. % of said dissolvable magnesium cast composite.	AJM012, AJM017, and AJM018 satisfy Claim 27, and include copper constituting between 0.5-15 wt. %.
69	The dissolvable magnesium cast composite as defined in Claim 28, wherein said additive material includes copper, said copper constitutes 0.5-15 wt. % of said dissolvable magnesium cast composite.	AJM018 satisfies Claim 28, and include copper constituting between 0.5-15 wt. %.
76	The dissolvable magnesium cast composite as defined in Claim 19, wherein said additive material includes one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 19 and include one or more metal materials selected from the group consisting of 0.1-35 wt. % copper and 01.-24.5 wt. % nickel.
77	The dissolvable magnesium cast composite as defined in Claim 29, wherein said additive material includes one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt.	AJM018 and AJM023 satisfy Claim 29 and include one or more metal materials selected from the group consisting of 0.1-35 wt. % copper and 0.1-24.5 wt. % nickel.
78	The dissolvable magnesium cast composite as defined in Claim 22, wherein said additive material includes one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt.	AJM018 and AJM023 satisfy Claim 22, and include one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel.
79	The dissolvable magnesium cast composite as defined in Claim 23, wherein said additive material includes one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 23 and all include one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, and 01.-24.5 wt. % nickel.

80	The dissolvable magnesium cast composite as defined in Claim 27, wherein said additive material includes one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 27 and all include one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, and 01.-24.5 wt. % nickel.
81	The dissolvable magnesium cast composite as defined in Claim 28, wherein said additive material includes one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt.	AJM018 and AJM023 satisfy Claim 28, and include one or more metal materials selected from the group consisting of 0.1-35 wt. % copper, 0.1-24.5 wt. % nickel.
82	The dissolvable magnesium cast composite as defined in Claim 19, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 19 and have one or more properties selected from the group consisting of a) a tensile strength of at least 29 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.
83	The dissolvable magnesium cast composite as defined in Claim 20, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 20 and have one or more properties selected from the group consisting of a) a tensile strength of at least 29 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.
84	The dissolvable magnesium cast composite as defined in Claim 22, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 22 and have one or more properties selected from the group consisting of a) a tensile strength of at least 36 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.

85	The dissolvable magnesium cast composite as defined in Claim 25, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 25 and have one or more properties selected from the group consisting of a) a tensile strength of at least 36 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.
86	The dissolvable magnesium cast composite as defined in Claim 27, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM006, AJM010, AJM012, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 27 and have one or more properties selected from the group consisting of a) a tensile strength of at least 29 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.
87	The dissolvable magnesium cast composite as defined in Claim 28, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 28 and have one or more properties selected from the group consisting of a) a tensile strength of at least 36 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.
88	The dissolvable magnesium cast composite as defined in Claim 19, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of 14-50 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.	AJM010, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 19 and have one or more properties selected from the group consisting of a) a tensile strength of 29-39 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.
89	The dissolvable magnesium cast composite as defined in Claim 20, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of 14-50 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.	AJM010, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 20 and said dissolvable magnesium cast composites have one or more properties selected from the group consisting of a) a tensile strength of 29-39 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.

90	The dissolvable magnesium cast composite as defined in Claim 22, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of 14-50 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 22 and have one or more properties selected from the group consisting of a) a tensile strength of 36-39 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.
91	The dissolvable magnesium cast composite as defined in Claim 23, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of 14-50 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.	AJM010, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 23 and have one or more properties selected from the group consisting of a) a tensile strength of 29-39 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.
92	The dissolvable magnesium cast composite as defined in Claim 27, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of 14-50 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.	AJM010, AJM016, AJM017, AJM018, and AJM023 satisfy Claim 27 and have one or more properties selected from the group consisting of a) a tensile strength of 29-39 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.
93	The dissolvable magnesium cast composite as defined in Claim 28, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of 14-50 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 28 and have one or more properties selected from the group consisting of a) a tensile strength of 36-39 ksi, b) a shear strength of 11-25 ksi, and c) an elongation of at least 3%.
94	A dissolvable magnesium cast composite	AJM018 and AJM023 are dissolvable magnesium cast composites
	comprising a mixture of magnesium or a magnesium alloy and an additive material,	AJM018 and AJM023 comprise a mixture of magnesium or magnesium alloy and an additive material

	said additive material includes a) nickel wherein said nickel constitutes 0.01-5 wt. % of said dissolvable magnesium cast composite or b) nickel wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite,	AJM018 and AJM023 include nickel constituting between 0.01-5 wt. %, or constituting between 0.1-23.5 wt. %.
	said dissolvable magnesium cast composite includes in situ precipitate,	AJM018 and AJM023 have in situ precipitate
	said in situ precipitate includes said additive material,	AJM018 and AJM023 have in situ precipitate that includes said additive material
	said dissolvable magnesium cast composite has a dissolution rate of at least 75 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 and AJM023 have a dissolution rate of at least 75 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
95	The dissolvable magnesium cast composite as defined in Claim 94, wherein said dissolvable magnesium cast composite includes no more than 10 wt. % aluminum.	AJM018 and AJM023 satisfy Claim 94 and include aluminum constituting no more than 10 wt. %.
96	The dissolvable magnesium cast composite as defined in Claim 94, wherein said dissolvable magnesium composite cast includes at least 85 wt. % magnesium.	AJM018 and AJM023 satisfy Claim 94 and include magnesium constituting at least 85 wt. %. .
97	The dissolvable magnesium cast composite as defined in Claim 95, wherein said dissolvable magnesium cast composite includes at least 85 wt. % magnesium.	AJM018 and AJM023 satisfy Claim 95 and include magnesium constituting at least 85 wt. %.
98	The dissolvable magnesium cast composite as defined in Claim 94, wherein said dissolvable magnesium cast composite has a dissolution rate of 75-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 and AJM023 satisfy Claim 94 and have a dissolution rate between 75-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.

99	The dissolvable magnesium cast composite as defined in Claim 97, wherein said dissolvable magnesium cast composite has a dissolution rate of 75-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.	AJM018 AND AJM023 satisfy Claim 97 and have a dissolution rate between 75-325 mg/cm**2/hr. in 3 wt. % KCl water mixture at 90.degree. C.
100	The dissolvable magnesium cast composite as defined in Claim 94, wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM018 and AJM023 satisfy Claim 94 and include nickel constituting between 0.1-23.5 wt. %.
101	The dissolvable magnesium cast composite as defined in Claim 99, wherein said nickel constitutes 0.1-23.5 wt. % of said dissolvable magnesium cast composite.	AJM018 and AJM023 satisfy Claim 99 and include nickel constituting between 0.1-23.5 wt. %.
102	The dissolvable magnesium cast composite as defined in Claim 94, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 94 and have one or more properties selected from the group consisting of a) a tensile strength of at least 36 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.
103	The dissolvable magnesium cast composite as defined in Claim 101, wherein said dissolvable magnesium cast composite has one or more properties selected from the group consisting of a) a tensile strength of at least 14 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.	AJM018 and AJM023 satisfy Claim 101 and have one or more properties selected from the group consisting of a) a tensile strength of at least 36 ksi, b) a shear strength of at least 11 ksi, and c) an elongation of at least 3%.